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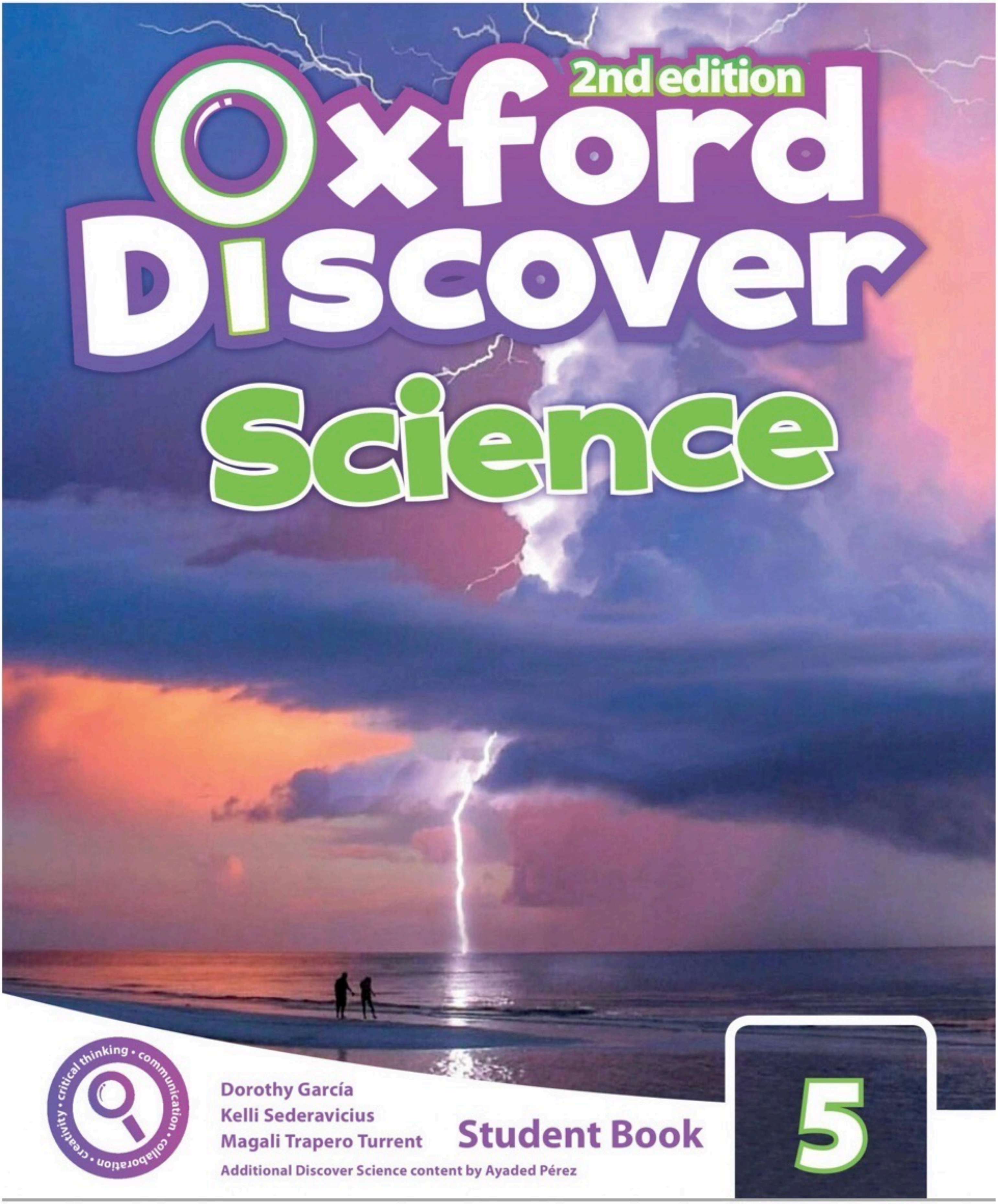

2nd edition

Oxford Discover Science

critical thinking • communication • collaboration • creativity

Dorothy García
Kelli Sederavicius
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Student Book

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2nd edition

Oxford Discover Science

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Student Book

Dorothy García
Kelli Sederavicius
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How to use your Classroom Presentation Tool

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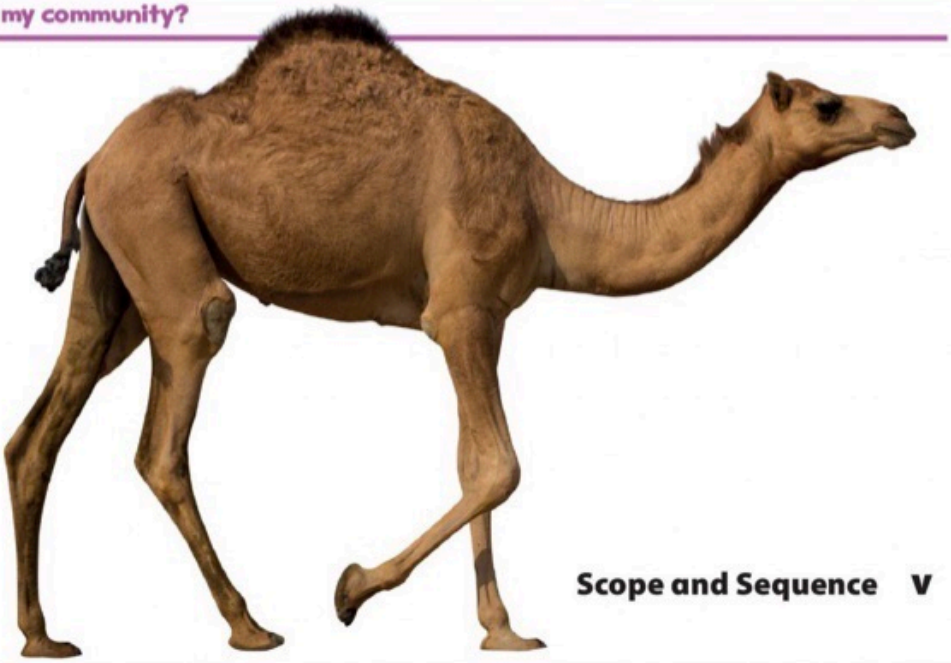
Scope and Sequence

BLOCK 1 The Human Body

	Objective	Skills for doing science	Vocabulary
Unit 1 What Happens If I Don't Keep a Healthy Weight?			
Lesson 1 **How are food and energy related?**	Demonstrate the relationship between energy balance and a healthy weight	Interpret data	Basal Metabolic Rate (BMR), calorie, Energy_{in}, Energy_{out}, energy balance, food label, serving size
Lesson 2 **How does energy imbalance affect my health?**	Describe the causes and consequences of obesity and other eating disorders	Draw conclusions from data	anorexia nervosa, Body Mass Index (BMI), bulimia, diabetes mellitus, eating disorders, glucose, insulin, malnutrition, normal weight, obesity, overweight, pancreas, underweight
Project: How much energy do I need?			
Unit 2 How Do We Change and Develop During Our Lifetime?			
Lesson 1 **What are the stages of life?**	Explain the stages and characteristics of human development	Compare and contrast the key events and features of each stage in the human life cycle.	adolescence, adulthood, aging process, bone density, cataracts, cells, cerebellum, childhood, coordination, ear canal, eardrum, elderly, emotional, empathy, fetus, frontal lobe, glaucoma, gross and fine motor skills, growth spurt, high blood pressure, hormones, impulse control, independent, infancy, interact, melanin, mood swings, neuron, neurotransmitter, occipital lobe, old age, parietal lobe, physical, puberty, self-esteem, social, stamina, strength, temporal lobe, womb
Lesson 2 **How can we care for people throughout their lifetime?**	Describe the relationship between human needs and the provision of care throughout the life cycle	Put items in a progressive order	acceptance, behavior, belonging, community, caregiver, esteem, identity, motivation, needs, physiological, potential, psychological, recognition, respect, safety, security, self-actualization, shelter, society, survival, umbilical cord
Project: Do other mammals go through complex changes and developments in their lives?			

BLOCK 2 The Environment

	Objective	Skills for doing science	Vocabulary
Unit 1 What Will Happen If We Don't Protect Our Ecosystems?			
Lesson 1 **Why is biodiversity important?**	Recognize the varieties of living organisms on Earth and explain the importance of biodiversity	Communicate in a debate	abiotic factors, acellular, animalae, archaea, bacteria, biodiversity, biotic factors, development, eukaryotae, fungi, growth, irritability, metabolism, movement, multicellular, plantae, prokaryotae, protista, reproduction, unicellular, virus
Lesson 2 **What happens when a region loses its native plants and animals?**	Identify endemic species and the consequences of loss of native plants and animals in a region	Predict results based on trends	dam, endangered species, endemic species, flood, habitat degradation, habitat destruction, habitat fragmentation, habitat loss, invasive species, landslides, logging, scarcity, soil erosion, trawling, urban sprawl, wildfires
Project: What native species in my country are endangered?			
Unit 2 Why Are Ecosystems So Important?			
Lesson 1 **What do ecosystems do for all of us?**	Compare the basic characteristics of ecosystems and describe the services that they provide	Classify elements from ecosystem services	biome, climate, cultural services, desert, forest, freshwater, grassland, marine, provisioning services, regulating services, supporting services, tundra
Lesson 2 **What can we do to care for ecosystems?**	Identify actions to implement that can prevent ecosystem depletion and biodiversity loss	Make inferences based on facts	compost, crops, grazing, gyres, horizons, livestock, manure, mulch, smart growth, soil, sustainable agriculture, sustainable communities, topsoil, 3Rs (reduce, reuse, recycle)
Project: How do ecosystems benefit my community?			



BLOCK 3 Matter and Materials

	Objective	Skills for doing science	Vocabulary
Unit 1 Why Is Water Important for Our Planet?			
Lesson 1 **How does water function as a solvent?**	Identify water as an important component of living organisms and as a natural solvent of many substances	Identify solutes and solvents in liquid solutions	breath, concentration, dehydration, diarrhea, freshwater, homogeneous, perspiration, solubility, solute, solution, solvent, water loss
Lesson 2 **How can we prevent water pollution?**	Determine the relationship between solubility and water pollution, and identify measures to prevent water pollution	Make inferences based on facts	activated sludge, aeration tanks, bar screens, chlorine, clarification tanks, effluent, grit tanks, influent, petroleum distillates, phosphates, residual water treatment plant, scum, sedimentation tanks, septic tank, sludge, stabilization pond, total suspended solids (TSS), turbidity, wastewater
Project: What effect does water pollution have on a community?			
Unit 2 What Mixtures Are There in Our Environment?			
Lesson 1 **How do mixtures separate?**	Recognize the physical properties of materials that change when the materials are mixed	Classify mixtures	colloid, component, distillation, evaporation, filtration, heterogeneous, magnetic method, mixture, physical changes, pure substances, sieving, suspension
Lesson 2 **How can we care for our atmosphere?**	Identify air as a mixture and propose actions to prevent air pollution	Classify air pollutants and their main sources	atmosphere, biomass power, carbon monoxide (CO), emissions, fossil fuels, geothermal power, nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), solar power, stratosphere, sulfur dioxide (SO_2), troposphere, volatile organic compounds (VOCs), wind power
Project: Are there suspended particles in the air we breathe?			

BLOCK 4 Energy and Forces

	Objective	Skills for doing science	Vocabulary
Unit 1 Is There Only One Kind of Energy?			
Lesson 1 **Why do astronauts seem to float?**	Describe the concept of energy and its types, and identify the relationship between natural phenomena and gravity	Manipulate variables	energy, escape velocity, force of attraction, freefalling, gravitational potential energy (PE_{grav}), gravity, Joule (J), Law of Universal Gravitation, mass, matter, Newton (N), non-renewable sources of energy, ocean currents, potential energy, renewable sources of energy, variables, weight
Lesson 2 **What is sound and how does it work?**	Identify the relationship between the vibration of objects and sound propagation, and the impact of sound pollution on hearing	Interpret sound wave graphs	amplitude, anvil, auditory nerve, cochlea, decibels (dB), ear canal, eardrum, earplugs, echo, frequency, hammer, Hertz (Hz), infrasound, intensity, medium, noise pollution, pinna, pitch, propagate, reflection, sound, stirrup, ultrasound, vibration, wave, wavelength
Project: Why does launching a rocket create so much noise?			
Unit 2 How Does Energy Transform?			
Lesson 1 **How does an electric circuit produce light?**	Identify the functions and everyday applications of electric circuits	Model electric circuits through diagrams	atom, attract, closed circuit, conductors, electric circuit, electric current, electric energy, electrocution, electrons, insulators, negative charge, open circuit, parallel circuit, positive charge, power source, protons, repel, resistance, resistor, series circuit, static electricity, switch
Lesson 2 **What kind of changes does heat cause?**	Describe heat transfer processes and their importance	Identify heat conductors and insulators	boiling point, chemical burns, chemical changes, conduction, convection, degrees Celsius (°C), freezing point, heat, molecules, radiation, radiation burns, temperature, thermal burns, thermal conductors, thermal energy, thermal insulators, thermometer
Project: How does electric energy transform into heat?			

BLOCK 5 Science Fair

Does BMI affect your heart rate? · Do detergents affect plant growth?
Does dirt concentration affect the turbidity of water? · Do loud sounds affect your memory?

Your Book

1 **Get to know your *Discover Science* book. Circle the correct answer.**

a What is on the cover of your science book?

1 a river   2 lightning   3 an airplane

b Your book is divided into blocks. How many are there?

1 four blocks   2 three blocks   3 five blocks

c How many lessons are included in blocks 1–4?

1 six lessons   2 two lessons   3 four lessons

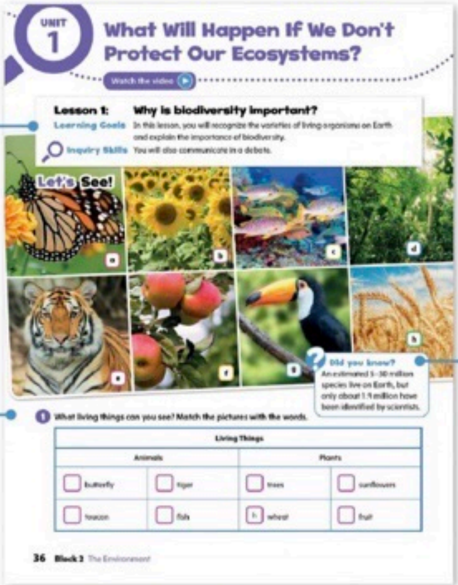
d What is the last section of your book?

1 a project   2 a glossary   3 a test

Your book tells you what you will learn.

You will observe and analyze pictures about science topics.

You will learn fun facts about science topics.



UNIT 1

What Will Happen If We Don't Protect Our Ecosystems?

Watch the video

Lesson 1: Why is biodiversity important?

Learning Goals In this lesson, you will recognize the varieties of living organisms on Earth and explain the importance of biodiversity.

Inquiry Skills You will also communicate in a debate.

Let's See!

Did you know? An estimated 5–30 million species live on Earth, but only about 1.9 million have been identified by scientists.

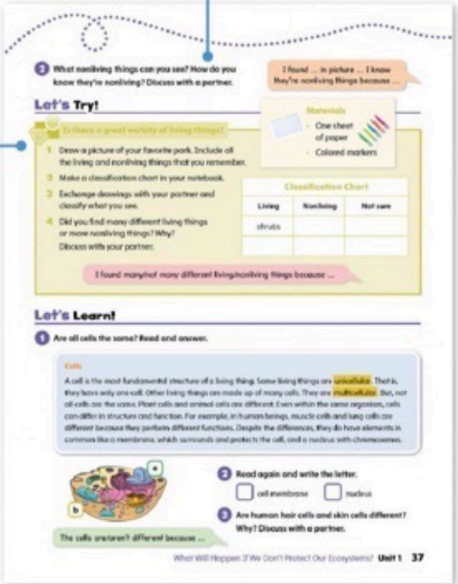
1 What living things can you see? Match the pictures with the words.

Living Things			
Animals		Plants	
☐ butterfly	☐ tiger	☐ trees	☐ sunflowers
☐ toucan	☐ fish	h wheat	☐ fruit

36 Block 2 The Environment

You will think and discuss.

You will do short science activities.



2 What nonliving things can you see? How do you know they're nonliving? Discuss with a partner.

I found ... in picture ... I know they're nonliving things because ...

Let's Try!

Is there a great variety of living things?

Materials
- One sheet of paper
- Colored markers

1 Draw a picture of your favorite park. Include all the living and nonliving things that you remember.
2 Make a classification chart in your notebook.
3 Exchange drawings with your partner and classify what you see.
4 Did you find many different living things or more nonliving things? Why? Discuss with your partner.

Classification Chart		
Living	Nonliving	Not sure
shrubs		

I found many/not many different living/nonliving things because ...

Let's Learn!

1 Are all cells the same? Read and answer.

Cells

A cell is the most fundamental structure of a living thing. Some living things are unicellular. That is, they have only one cell. Other living things are made up of many cells. They are multicellular. But, not all cells are the same. Plant cells and animal cells are different. Even within the same organism, cells can differ in structure and function. For example, in human beings, muscle cells and lung cells are different because they perform different functions. Despite the differences, they do have elements in common like a membrane, which surrounds and protects the cell, and a nucleus with chromosomes.

2 Read again and write the letter.

☐ cell membrane ☐ nucleus

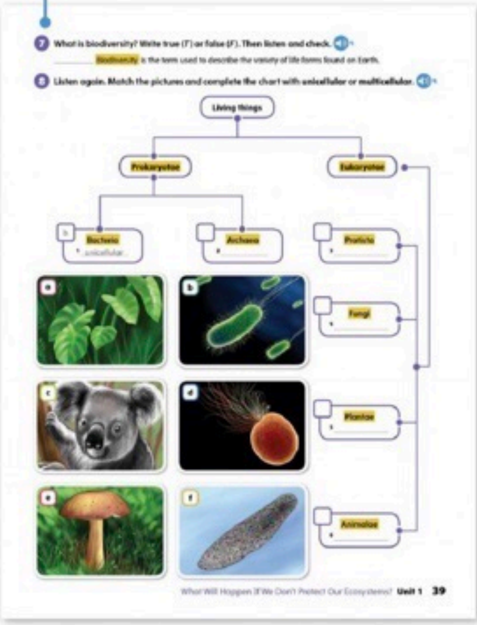
3 Are human hair cells and skin cells different? Why? Discuss with a partner.

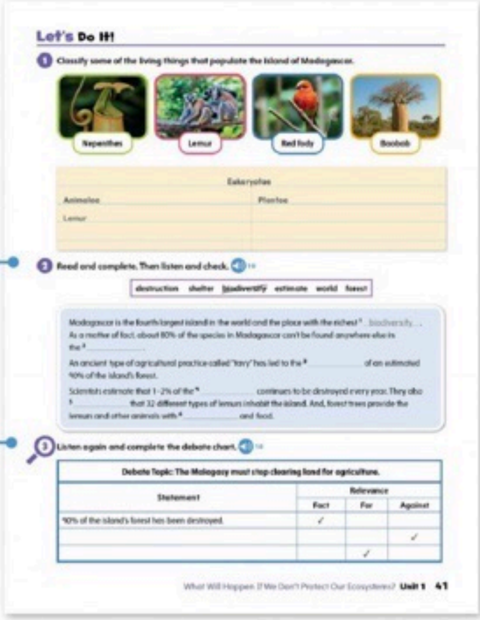
The cells are/aren't different because ...

What Will Happen If We Don't Protect Our Ecosystems? Unit 1 37

You will listen to conversations between students your age and scientists, or other professionals.

You will apply the concepts you learned in the lesson to different situations.

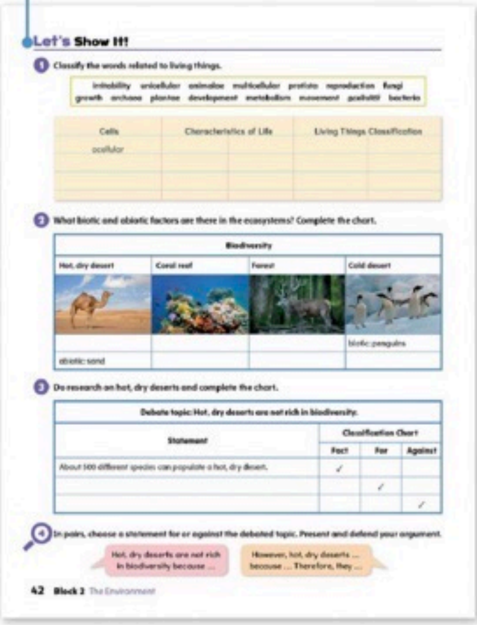



Let's Do It!

You will apply the skills you learned in the lesson to different situations.

You will show what you have learned.

You will do longer science projects.


Let's Show It!

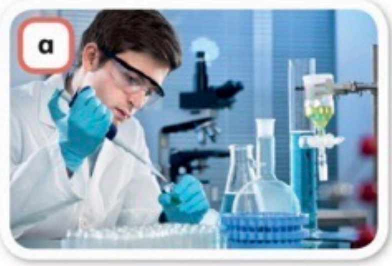
Project

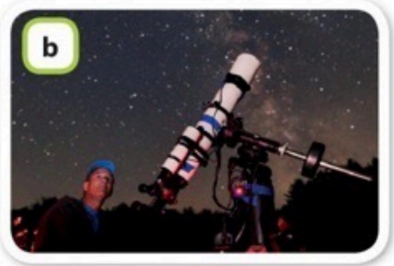
What native species in my country are endangered?

Being a Scientist

Learning Goals In this lesson, you will learn what scientists do.

1 **What kind of scientists are they? How do you know? Discuss with a partner.**





The scientist in picture ...
is a ... because ...

2 **Read and complete. Match the texts to the kind of scientists in activity 1.**

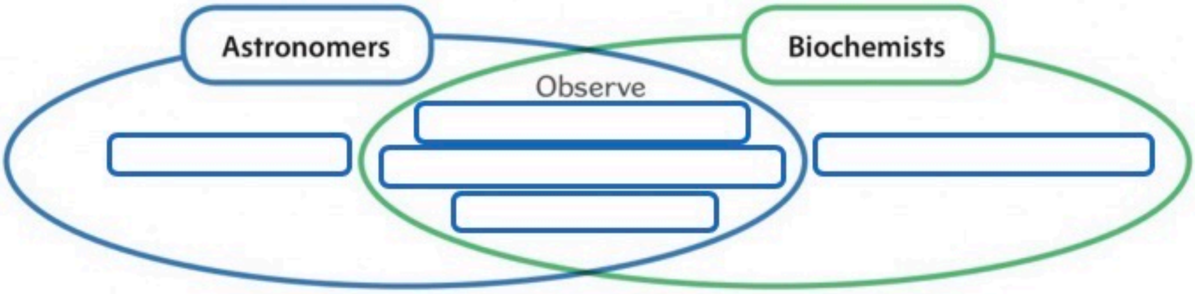
~~universe~~ park part years things study university reading

Working to Solve Mysteries

☐ Ever since I was a child, the whole idea of the Big Bang Theory and the birth of the 1 universe really caught my imagination. I went to school for many years until I got a doctorate degree (PhD) from a university in the United States. Now, I work for an observatory. This is a place that has powerful telescopes to observe the universe. So, I get to study the most mysterious element of the universe: dark matter. Dark matter is something that can't be seen. So, what I do to study dark matter is to measure, collect, and interpret data on the movement of dwarf galaxies and other bodies in the universe. The most fascinating 2 ________ of my job is to discover something new. And, I've discovered three dwarf galaxies that no one had ever seen before. Besides my job, I also like doing other 3 ________. I'm the mother of three adorable little boys and enjoy spending time with them. I also love playing guitar and 4 ________.

☐ I think I decided what I wanted to 5 ________ when I was about ten years old. I knew that I wanted to become the kind of scientist that could make medications because I lived next to a children's hospital. So, I went to school for many years and got a master's degree from a 6 ________ in Germany. Since then, I've been working for a pharmaceutical company. We've recently developed a new medication that may help children with serious brain injury lead a productive life. We do many observations, conduct research, collect data, interpret data, and, the best part, we can make exciting discoveries. Of course, creating a new medication takes many 7 ________ because we have to do many trials and also test the medication before we administer it to people. Besides my job, I enjoy jogging in the afternoon and going out with my wife and children to the 8 ________. We travel frequently together because we belong to a bird watching club.

3 What do astronomers and biochemists have in common? Complete the Venn diagram with information from activity 2.



4 What do you know about science? Discuss with a partner. Then read and check.

Science is about ... because ...

DAILY NEWS

SCIENCE

Science is a practice of discovery about the natural world and its processes. It's ongoing because there are many mysteries about the universe and about life. And, it is a process of inquiry. That is, it begins with questions about the world and how phenomena occur. Scientists live with the excitement of discovering something. The process of scientific inquiry is flexible. It involves coming up with questions and designing research methods to answer those questions. It also involves making predictions, gathering data, using evidence to propose explanations, and communicating with other scientists about research and results. Scientists work with skills that are a part of scientific inquiry: from basic ones like observing, measuring, classifying, inferring, predicting, and communicating, to more complex skills, such as hypothesizing, experimenting, or interpreting data.

5 Read again and complete the sentences with words from the text.

a Science is an ongoing process.

b Scientists live with the ____ of discovering something new.

c The process of scientific inquiry is ____ which allows scientists to use a variety of approaches in their research.

d Observation is a basic ____ skill that involves the use of the five senses.

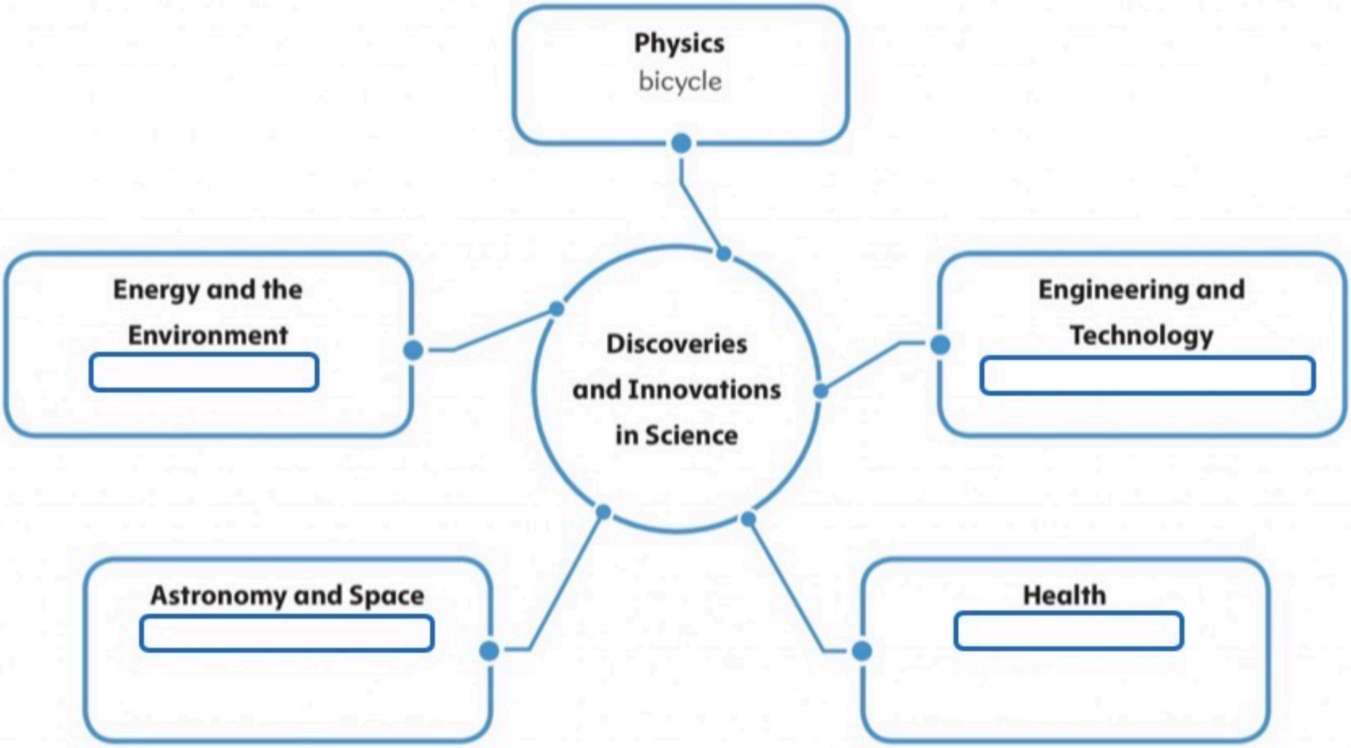
e Hypothesizing and interpreting data are examples of ____.

6 **Where is science applied? Discuss in small groups.**

Science is applied in ...
For example ...

7 **Complete the mind map about discoveries and innovations in science. Use the words from the box to begin.**

~~bicycle~~ aspirin solar panels galaxies neurosurgical simulator


Physics
bicycle
Energy and the Environment
Discoveries and Innovations in Science
Engineering and Technology
Astronomy and Space
Health

8 **Science can be fascinating. Every day scientists get to ask questions and learn new things. Browse some of the links below and get connected to the world of science.**

Science Sites for Children

Would you like to stay informed with news about science for children?
http://www.sciencenewsforkids.org/?gclid=CKGl6NykrrcCFajm7AodDjwANw

Are you interested in learning more about the universe in a fun way?
http://www.nasa.gov/audience/forkids/kidsclub/flash/index.html

Do you want to know how children are learning about science and the natural world?
http://kids.nationalgeographic.com/kids/

BLOCK ①

The Human Body

Find words for each picture.

identity
physiological
behavior
ear canal
glaucoma
growth spurt
motivation
interact
Basal Metabolic Rate (BMR)
melanin
society
balance
cells
bone density
childhood
aging process
Energy$_{out}$
adulthood
adolescence
gross and fine motor skills
high blood pressure
shelter
survival
self-actualization
cerebellum
neurotransmitter
serving size
elderly
hormones
anorexia nervosa
frontal lobe
glucose
malnutrition
emotional
insulin
mellitus
diabetes
Body Mass Index (BMI)
bulimia
underweight
cataracts
impulse control
infancy
eardrum
social
womb
empathy
coordination
neuron
temporal lobe
old age
overweight
acceptance
independent
occipital lobe
parietal lobe
puberty
self-esteem
obesity
pancreas
fetus
energy
eating disorders
normal weight
caregiver
community
potential
recognition
stamina
strength
calories
food label
Energy$_{in}$
belonging
esteem
security
mood swings
needs

UNIT 1

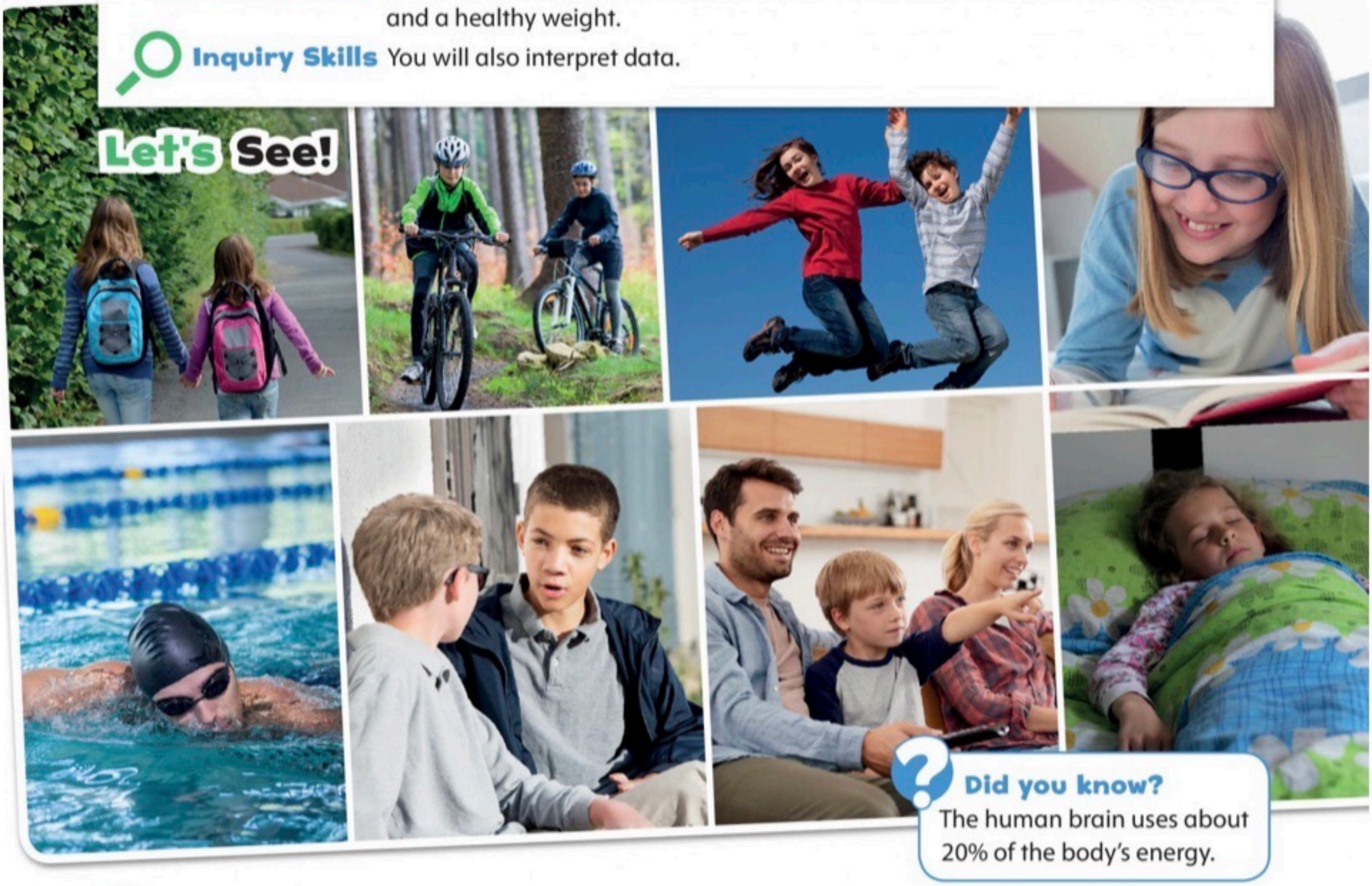
What Happens If I Don't Keep a Healthy Weight?

Watch the video ▶

Lesson 1: How are food and energy related?

Learning Goals In this lesson, you will demonstrate the relationship between energy balance and a healthy weight.

Inquiry Skills You will also interpret data.



Did you know?
The human brain uses about 20% of the body's energy.

① Look at the pictures and classify the activities.

Takes More Energy			Takes Less Energy		
riding a bike			watching TV		

② Where does the energy to do activities come from? Discuss with a partner.

The energy to do activities comes from ...

Let's Try!

How Does Our Body Use Energy?

1 Draw the energy chart on the poster board.

2 Cut out pictures of different activities from magazines.

3 Classify the pictures according to the amount of energy that it takes to do them.

4 Glue the pictures in the corresponding column.

5 How do you feel when you have lots of energy? Discuss in small groups.

When I have lots of energy, I feel like I ...

Materials

- One poster board
- One black marker
- Scissors
- Magazines
- One glue stick

Energy Expenditure Chart

LOW	MEDIUM	HIGH

Let's Learn!

① **Complete the sentence. Then read and compare your answer.**

The energy in our body comes from

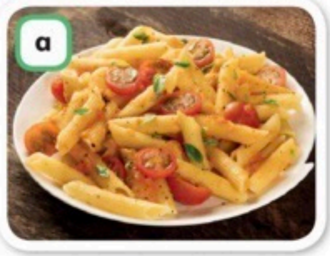
Energy$_{in}$

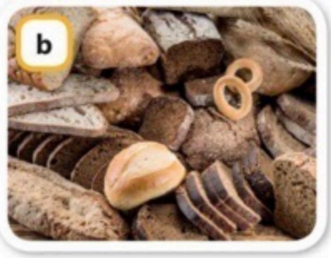
The food we eat and the beverages we drink contain substances called nutrients. Our body uses nutrients like vitamins and minerals to function and repair itself. Vitamins and minerals do not give our body energy. Energy comes from nutrients called proteins, carbohydrates, and fats. The energy we receive from these three nutrients is measured in calories. Calories tell us the amount of energy we can get from our food or drinks. Proteins and carbohydrates can give us four calories per gram (4 cal./g), and fat can give us nine calories per gram (9 cal./g). This energy we receive from food and drinks is called Energy$_{in}$.

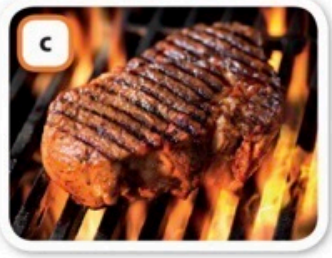
② **How much energy do we get from nutrients? Read again and complete the chart.**

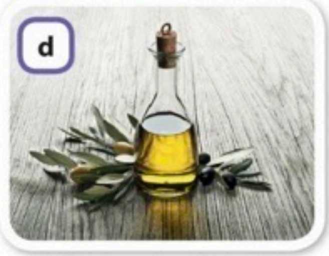
Nutrients That Give Us Energy		Energy From Nutrients: Energy$_{in}$
carbohydrates		

③ Look and classify the foods.



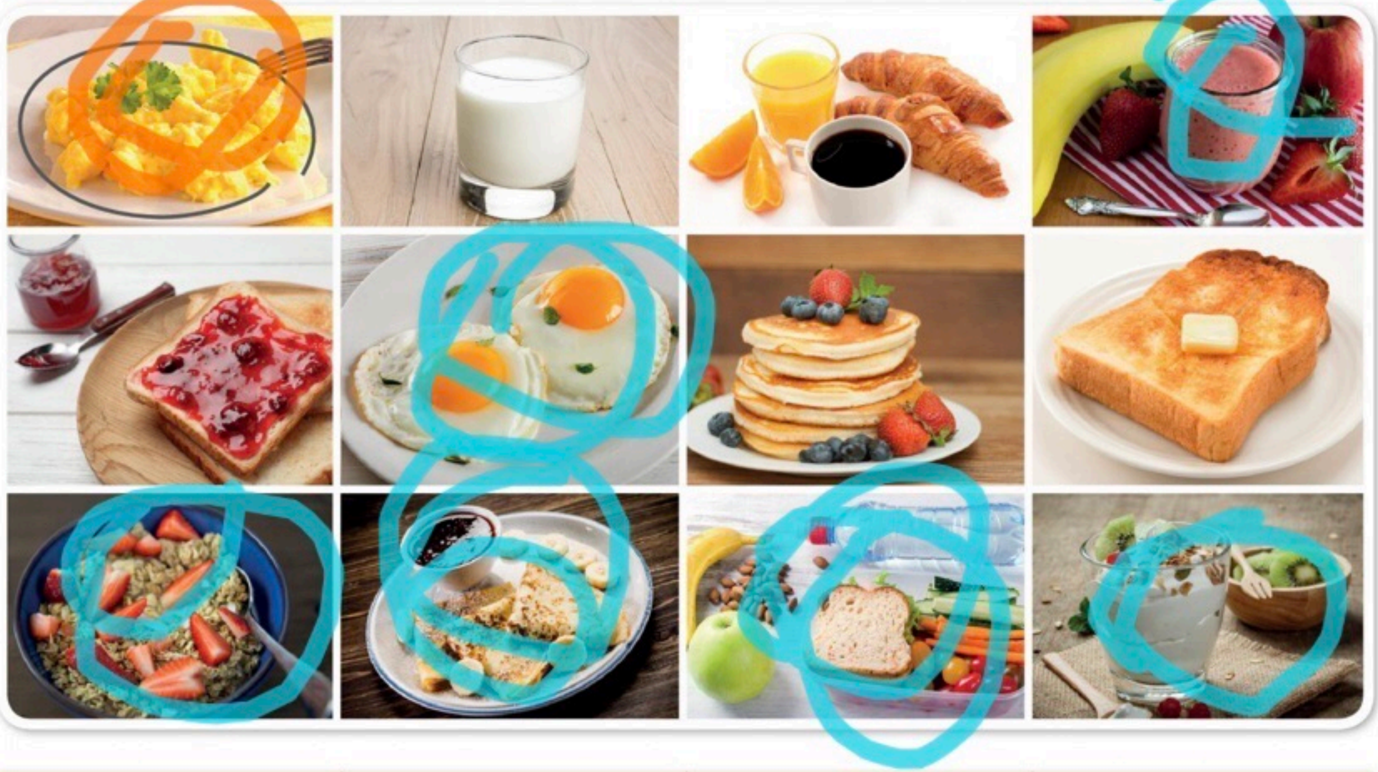






Carbohydrates		Proteins	Fats
pasta			

④ Look at the pictures. Circle the foods that you usually eat for breakfast. Then classify the foods.



Carbohydrates	Proteins	Fats	Other
		butter	

⑤ Which foods give you more energy? Discuss in small groups.

Two eggs give me more energy than an apple because …

Let's Do It!

1 Complete the sentence. Then read and compare your answer

I can find the amount of calories my food or drink has on ☐.

Food Labels

The food and drinks we buy in stores have a label. This food label gives us information about nutrients and calories contained in the food and drinks. It also gives us information about the serving size. A serving size is the amount of a food or drink that has the calories (energy) listed on the label. It is very difficult to know if what we put on our plate or in our glass is the correct serving size. We have to measure to be exact. Because it is difficult to measure food all the time, it is better to have a general idea of what a serving size looks like. If you know serving sizes, you can plan a healthy and balanced meal.

Wow Cereal

Nutrition Facts

Serving size ½ cup (75 g)
Servings per container 6

Amount per serving	
Calories 280	Calories from Fat 130
	% Daily Value
Total Fat 15 g	23 %
Saturated Fat 2 g	10 %
Trans Fat 0 g	
Polyunsaturated Fat 5 g	
Cholesterol 0 g	0 %
Sodium 35 mg	2 %
Total Carbohydrates 38 g	13 %
Dietary Fiber 8 g	33 %
Sugars 8 g	
Protein 9 g	

2 Use the food label. Calculate the total $\text{Energy}_{\text{in}}$ you get if you eat half of the box. Servings per container 6 ÷ 2 = ☐ servings in half a box

Servings in half a box ☐ × calories per serving ☐ = ☐ $\text{Energy}_{\text{in}}$ (calories)

3 How many servings of food do you have in your lunchbox? Compare with a partner.

I have two servings of cheese. What about you?

a fist

two fingers

a cupped hand

an open palm

tip of thumb

serving of fruit

serving of cheese

serving of dry cereal

serving of meat

serving of butter

4 Read and complete. Then listen and check. 1

~~essential~~ 746 (x2) energy (x2) BMR 17.5

Basal Metabolic Rate (BMR) is the energy our body uses for its ^{1} essential functions.
The energy used for physical activities plus ^{2} is called **Energy$_{out}$**. This represents the total amount of energy we use every day. When the ^{3} we receive from food and drinks equals the amount of ^{4} used for our essential body functions and our physical activities, this is called **energy balance**. It can be represented as Energy$_{in}$ = Energy$_{out}$.
The formula to calculate the BMR for boys between ten and eighteen years old is (^{5} × weight in kg) + 651. For girls, it is (12.2 × weight in kg) + ^{6} . For example, the BMR for an eleven-year-old girl who weighs 32 kg is (12.2 × 32 kg) + ^{7} = 1,136 cal./day.

5 George is ten years old and weighs 35 kg. Complete the table with his Energy$_{out}$.

402 cal./day
175 cal./day
85 cal./day
~~1,263 cal./day~~

Activity	Energy$_{out}$
playing video games	
swimming	
walking	
BMR	1,263 cal./day

6 How many calories does George need to get from his food and drinks to achieve energy balance? Complete the sentence.

George needs ^{1} calories per day of Energy$_{in}$ from food and drinks to achieve energy balance because his total Energy$_{out}$ is ^{2} calories per day.

Let's Do It!

1 **Look at Tammy. Why does she feel tired all the time?**
Discuss with a partner. Then listen and check your answer. 2

I think she's tired all the time because ...

2 **Listen again and complete the charts.** 2

Energy$_{out}$		Energy$_{in}$	
Activity	**Calories**	**Food**	**Calories**
sitting in class (6 hrs)	408	breakfast	
soccer (3 hrs)		lunch	475
basketball (2 hrs)		dinner	
BMR	1,136	snack	225
Total Energy$_{out}$	2,753	Total Energy$_{in}$	

3 **Read and complete the report with words from the box.**

energy carbohydrates 1,633 slept calories food ~~plays~~ 2,753 protein increase

Introduction Tammy is a ten-year-old girl and weighs 32 kg. She ^{1} plays on her school soccer team and practices sports for five hours every day. She told her coach that she felt tired all the time and that she always ate healthy food and ^{2} ______ well.

Materials and Methods The coach gave Tammy an Energy$_{in}$ and an Energy$_{out}$ chart. Tammy wrote in the Energy$_{in}$ chart the amount of ^{3} ______ and drinks she had on her busiest day of the week and the amount of ^{4} ______ for each portion. She used the food labels to calculate the amounts. In the Energy$_{out}$ chart, Tammy wrote down all the activities she did during the same day and the amount of time she spent on each activity. Her coach calculated the results using the school's Physical Activities Energy$_{out}$ chart.

Results The results in the charts show that Tammy uses a lot of ^{5} ______ every day. Her total amount of Energy$_{out}$ equals ^{6} ______ cal./day. But she is not getting enough energy from her food and drinks. Her total amount of Energy$_{in}$ equals ^{7} ______ cal./day.

Conclusion Tammy needs to ^{8} ______ her amount of Energy$_{in}$ by adding more healthy food to her diet. Her healthy diet needs to be rich in ^{9} ______ and ^{10} ______.

Let's Show It!

1 **Read and complete.**

calories Energy$_{out}$ serving size Basal Metabolic Rate (BMR)
Energy$_{in}$ ~~energy balance~~ food label

1 Energy balance means that the energy we receive from food and drinks, 2 ___, must equal the amount of energy we use for daily body functions (BMR) and our physical activities, 3 ___. And, a 4 ___ is the amount of a food or drink that contains the calories (energy) specified on the 5 ___. 6 ___ are a measure of the potential energy contained in what we eat and drink. And, 7 ___ is the energy our body needs for essential functions.

2 **Sam is eleven years old and weighs 50 kg. Complete his energy charts.**

ham and eggs – 695 ~~sitting in class – 300~~ playing video games – 100
watching TV – 155 sandwich – 475 candy bar – 325

Activity	Calories
sitting in class	300
___	___
___	___
BMR	1,526
Total Energy$_{out}$	___

Food	Calories
___	___
___	___
___	___
BMR	___
Total Energy$_{in}$	___

3 **Subtract the total amounts. Write the result.**

Energy$_{in}$ ___ – Energy$_{out}$ ___ = ___

4 **How can Sam achieve energy balance? Circle the correct answer.**

a He needs to increase the amount of Energy$_{in}$ by adding more healthy food to his diet.

b He needs to increase the amount of Energy$_{out}$ by adding physical activities to his daily routine.

Project

How Much Energy Do I Need?

In this project, you will make and analyze energy charts.

Stage 1: Plan your project

1. Make an Energy$_{\text{in}}$ chart.
2. Make an Energy$_{\text{out}}$ chart.
   - **a** Calculate your Basal Metabolic Rate (BMR) using the formula on page 6.
   - **b** Choose your favorite day of the week to record your data.

Name: Sophie Ragman			Date:	
Food or drink	Food label: serving size	Number of servings in my portion	Food label: calories per serving	Total calories (number of servings x calories per serving)
cereal	1/2 cup	2	280	2 x 280 = 560
TOTAL ENERGY$_{\text{IN}}$				

Name: Sophie Ragman			Date:	
Intensity	Type of activity	Minutes	Hours of activity (minutes ÷ 60)	Calories used (hours x calories)
VERY LIGHT 85 cal./hour	watch TV	120	120 ÷ 60 = 2	2 x 85 = 170
LIGHT 140 cal./hour	walk to school	30	30 ÷ 60 = 0.5	0.5 x 140 = 70
MODERATE 285 cal./hour	jump rope	90	90 ÷ 60 = 1.5	1.5 x 285 = 427
HEAVY 400 cal./hour				
ACTIVITIES ENERGY$_{\text{OUT}}$				
My activities Energy$_{\text{out}}$	+	My Basal Metabolic Rate (BMR)	=	TOTAL ENERGY$_{\text{OUT}}$

Stage 2: Develop your project

1. Record data in your Energy$_{\text{out}}$ chart.
2. Record data in your Energy$_{\text{in}}$ chart.
3. Did you achieve energy balance? Subtract your total amount of Energy$_{\text{out}}$ from the total amount of Energy$_{\text{in}}$.

UNIT 1

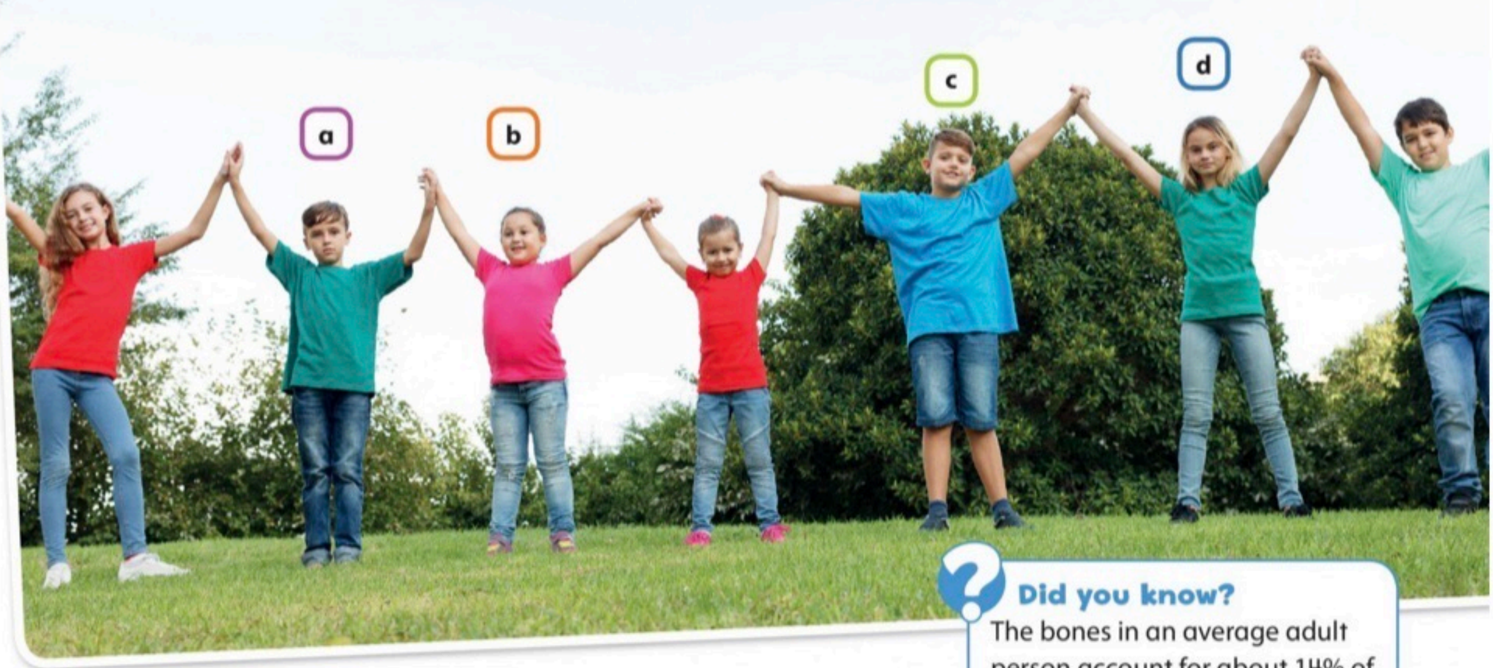
What Happens If I Don't Keep a Healthy Weight?

Lesson 2: How does energy imbalance affect my health?

Learning Goals In this lesson, you will describe the causes and consequences of obesity and other eating disorders.

Inquiry Skills You will also draw conclusions from data.

Let's See!



Did you know?
The bones in an average adult person account for about 14% of the person's total body weight.

1. How do the children look? Match the children to the words.

   c tall ☐ heavy ☐ short ☐ thin

2. Who has or does not have a healthy weight? Discuss with a partner.

I think ... has / doesn't have a healthy weight because ...

Let's Try!

Is There a Relationship Between Height and Weight?

1 Place two balls of modeling clay of about the same size and weight on the plate.

2 Mold each ball into a human figure of a different height.

3 Your teacher will weigh each figure.

4 How do the human figures look? Are they about the same weight? Why? Discuss with your partner.

Materials

- Modeling clay

- One paper plate

- One weighing scale

This human figure looks ... because ...

Let's Learn!

1 Is Sally's weight healthy? Look and say.

Sally's weight is 25.5 kg and height is 1.2 m.

2 Listen and complete the chart. 3

Weight	Body Mass Index (BMI)
Underweight	Below 18.5
Normal weight	
Overweight	
Obesity	30 and above

3 Listen again and complete the sentences. 3

Body Mass Index (BMI) is a measure scientists use to determine if our [1] weight is within a healthy range for our [2] ________. They use the following formula to [3] ________ it: BMI = mass (kg) ÷ (height (m) × height (m)).

4 Calculate Sally's BMI and complete the sentence. Check your answer in activity 1.

From the data, we can say that Sally is [1] ________ because her BMI is [2] ________, which is below [3] ________.

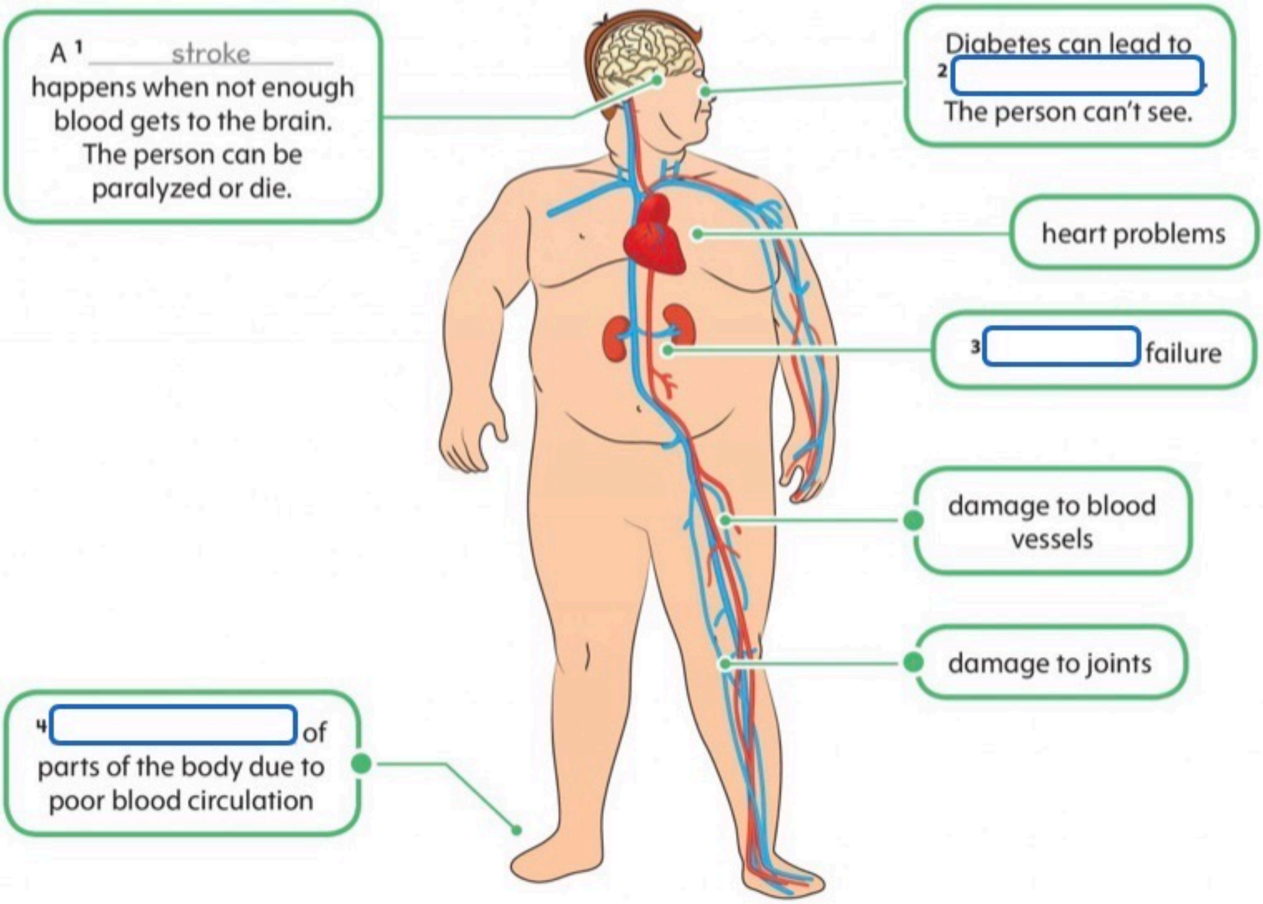
5 **What health problems can you have if you are overweight or obese? Mark (✓) all that apply. Then read and check.**

☐ hyperglycemia ☐ poliomyelitis ☐ diabetes mellitus ☐ laryngitis

Health Problems and Being Overweight

Over time, if our weight increases and our height stays about the same, our BMI gets higher. Overweight or obese people have a higher chance of developing diabetes mellitus among other illnesses. Diabetes mellitus is an illness in which the levels of glucose, or sugar, in our blood, are higher than normal. A lot of what we eat and drink is turned into glucose so that our body can use it for energy. We have an organ called the pancreas that produces a substance called insulin. Insulin helps our cells get glucose. If we have diabetes, the insulin our body produces is not enough. So the level of glucose in our body gets higher than normal. This state is called hyperglycemia. Diabetes can cause serious health problems that can lead to death. It can be the cause of strokes (when not enough blood gets to the brain), blindness, kidney failure, and amputations, among other problems.

6 **Read again and complete the illustration.**



A 1 stroke happens when not enough blood gets to the brain. The person can be paralyzed or die.

Diabetes can lead to 2 ______. The person can't see.

heart problems

3 ______ failure

damage to blood vessels

damage to joints

4 ______ of parts of the body due to poor blood circulation

7 **Why do you think these people are underweight? Discuss with your partner.**

The person in this picture is underweight because ...

8 **How do people become underweight? Answer true (T) or false (F). Then read and check.**

People become underweight when they follow a healthy low-fat diet.

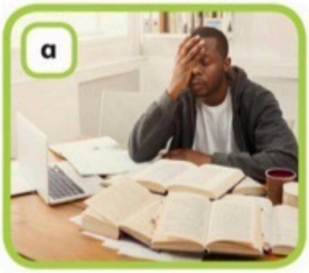
Malnutrition and Eating Disorders

A BMI of 18.5 or under indicates that a person is underweight. This condition can be a consequence of malnutrition and it can point to other serious health problems. Malnutrition can be the result of not eating enough healthy food, alcoholism, drug addiction, serious illnesses, or conditions like eating disorders. Eating disorders are abnormal eating habits that develop when a person is scared of becoming overweight or has psychological difficulties like low self-esteem. It usually accompanies a distorted body image. That means that the person may have a normal BMI but thinks that he/she is overweight. Anorexia nervosa and bulimia are two of these eating disorders. People with anorexia nervosa stop eating or eat very little and exercise a lot because they are terrified of becoming overweight. People with bulimia tend to eat a lot and then vomit what they ate and/or use laxatives to purge their body. Eating disorders are very serious and can lead to death.

9 **Read again and complete the chart.**

Examples of Eating Disorders	
Anorexia nervosa	**Bulimia**
stop eating or eat very little	
	vomit and/or use laxatives to purge their body

10 **What health problems can you have if you are underweight? Match the words to the pictures. Then read and check.**

a


b

c

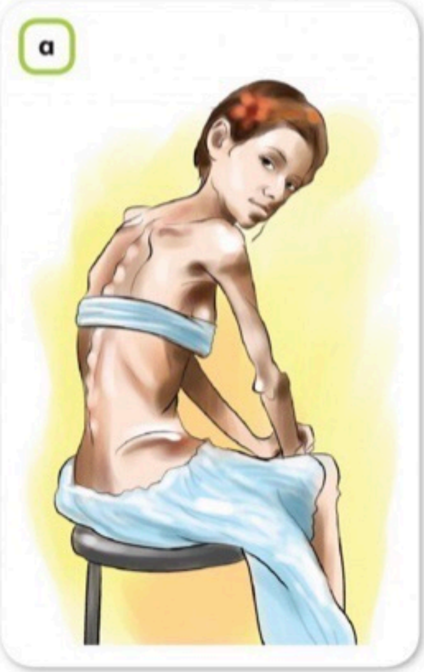
d

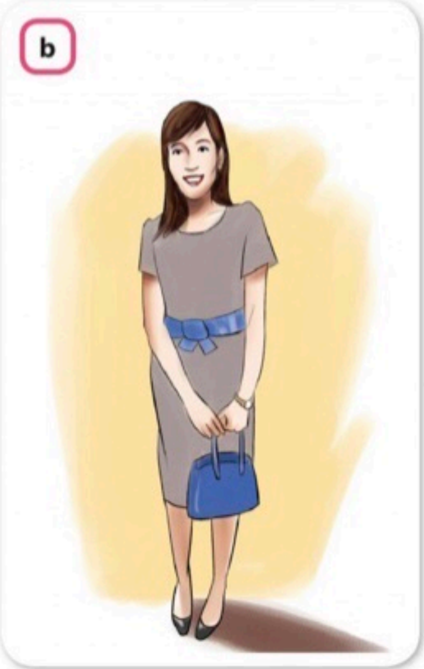
☐ fragile bones ☐ heart problems ☐ hair loss a fatigue

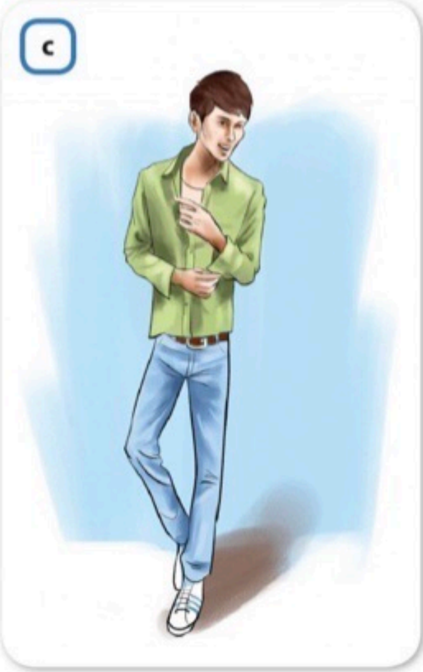
Health Problems and Being Underweight

Many people that look underweight or thin are healthy. The way they look is because of their natural constitution. But, diagnosed underweight people have a condition that can lead to serious health problems. They can have bones that are not strong enough, get sick easily, feel tired or without energy most of the time, feel cold frequently, or have heart problems. Also, they can have hair loss, their internal organs may stop working properly, and menstruation in women can stop. Over time, if an underweight person continues to lose weight, they can die.

11 **What's the difference between a person who looks underweight and a person diagnosed as underweight? Read again and discuss in small groups. Use the illustrations below as examples.**

a


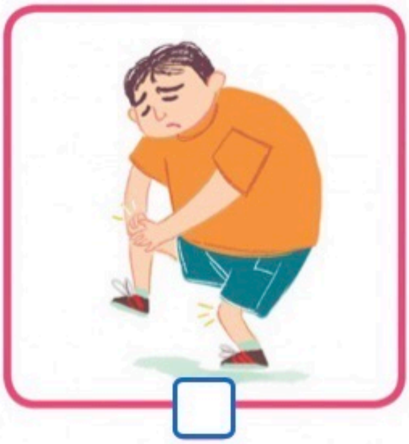
b


c


A person that looks underweight, like in this picture ...

Let's Do It!

1 Why do Milton's knees hurt? Order the pictures 1–3 according to what you think happened first. Then listen and check. 4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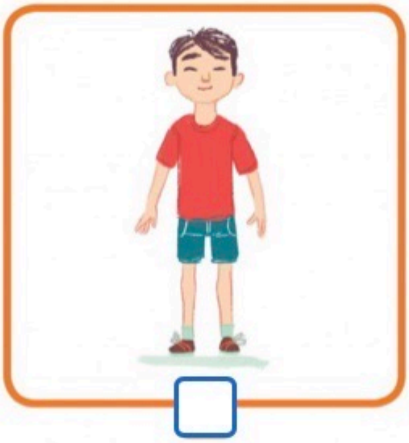
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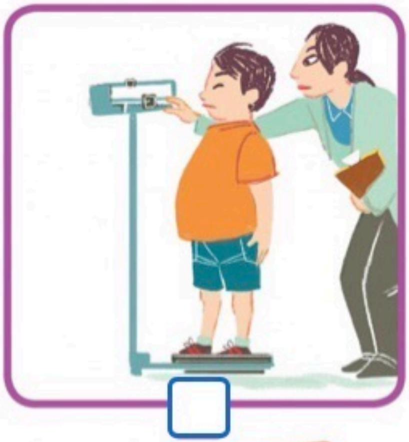
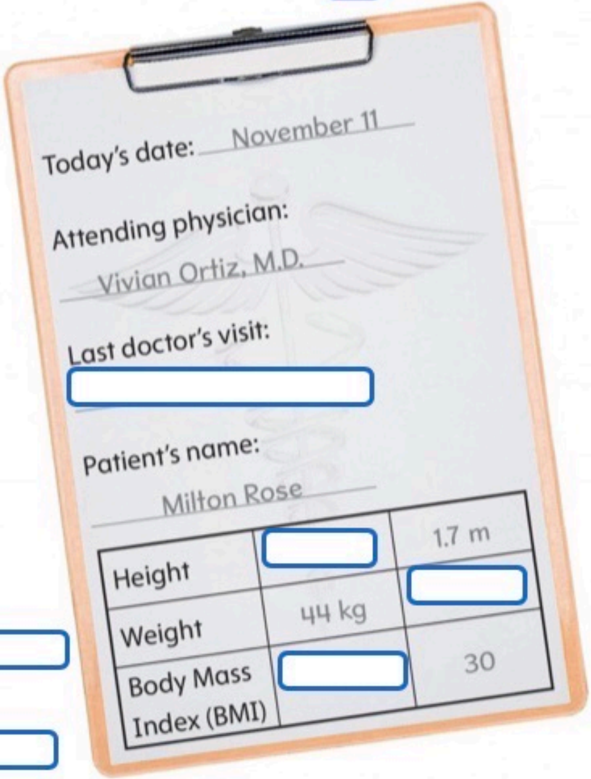

☐

2 Listen again and help Milton's doctor complete his medical history chart. 4



Today's date: November 11

Attending physician: Vivian Ortiz, M.D.

Last doctor's visit: ______

Patient's name: Milton Rose

Height	______	1.7 m
Weight	44 kg	______
Body Mass Index (BMI)	______	30

3 Complete the sentences with words from the box.

~~weight~~ since (x2) increased for (x2) knee

a Milton has had ___weight___ problems ______ he was five years old.

b Milton has been obese ______ four months.

c Milton's BMI has ______ a lot ______ his last doctor's visit.

d Milton has had ______ pain ______ two months.

4 Complete the sentences with data from Milton's chart and the BMI chart on page 11.

From the data, we can say that Milton is [1] ______ because his BMI is [2] ______. His knee problem may be a direct consequence of his [3] ______ problem.

Let's Show It!

1 Read and complete.

diabetes mellitus eating disorders glucose underweight obesity bulimia
~~Body Mass Index (BMI)~~ overweight anorexia nervosa malnutrition

Energy imbalance can seriously affect the health of a person. Scientists use a measurement called [1] Body Mass Index (BMI) to see if the weight of a person is within healthy limits. If that measurement is 18.5 or below, the person is diagnosed as [2] ______. That condition can lead to [3] ______ and may be the result of [4] ______ such as [5] ______ and [6] ______. When the measurement is within 25.0 to 29.9, the person is [7] ______. But, if the measurement reaches 30.0 or above, the person's weight falls in the [8] ______ range. People with this condition have a greater chance of developing [9] ______ and high levels of [10] ______ in their body.

2 Megan is 1.4 m tall and weighs 34 kg. She went to the doctor because she feels cold and without energy. Help Megan's doctor fill out her chart. Calculate her BMI.

Attending physician	Esteban Spencer, M.D.		
Patient's Name:	**Height**	**Weight**	**Body Mass Index (BMI)**
Megan Andrews	______	______	______

BMI = ______ kg ÷ (______ m × ______ m) = ______

3 Circle the correct answer.

Megan's BMI shows that her weight is in the ______ range.

a normal b overweight c underweight d obese

4 Complete the sentences.

From the data, we can say that Megan is diagnosed as [1] ______ because her BMI is [2] ______. She has a higher probability of developing other serious health problems such as [3] ______, [4] ______, and [5] ______.

Project

How Much Energy Do I Need?

In this project, you will make and analyze energy charts.

Stage 3: Share your project

1. Use the information on page 9 to write the first three sections of a report based on the results of your energy charts. Follow the report sample in activity 3, page 7.
2. Calculate your BMI following the formula in activity 3, page 11. Analyze your data and write a conclusion. Include the conclusion in your report.
3. Get into small groups and share your results.
   - **a** How many of you have energy balance / imbalance?
   - **b** How many of you are within / outside the normal weight range?

Stage 4: Evaluate your project

1. In small groups, follow this formula to calculate percentages.
2. Draw a large circle to make a pie chart. Estimate the slice that corresponds to the percentages in activity 1.
3. Evaluate the results using these expressions. Share your results with the rest of the class.

From the data, we can say that ... out of ... have energy balance / imbalance ...

A small / large percentage of students are ...

UNIT 1

Unit Review

1. Go back and **watch the video** ▶
2. Now complete the activities on your **Video Worksheet**

UNIT 2 How Do We Change and Develop During Our Lifetime?

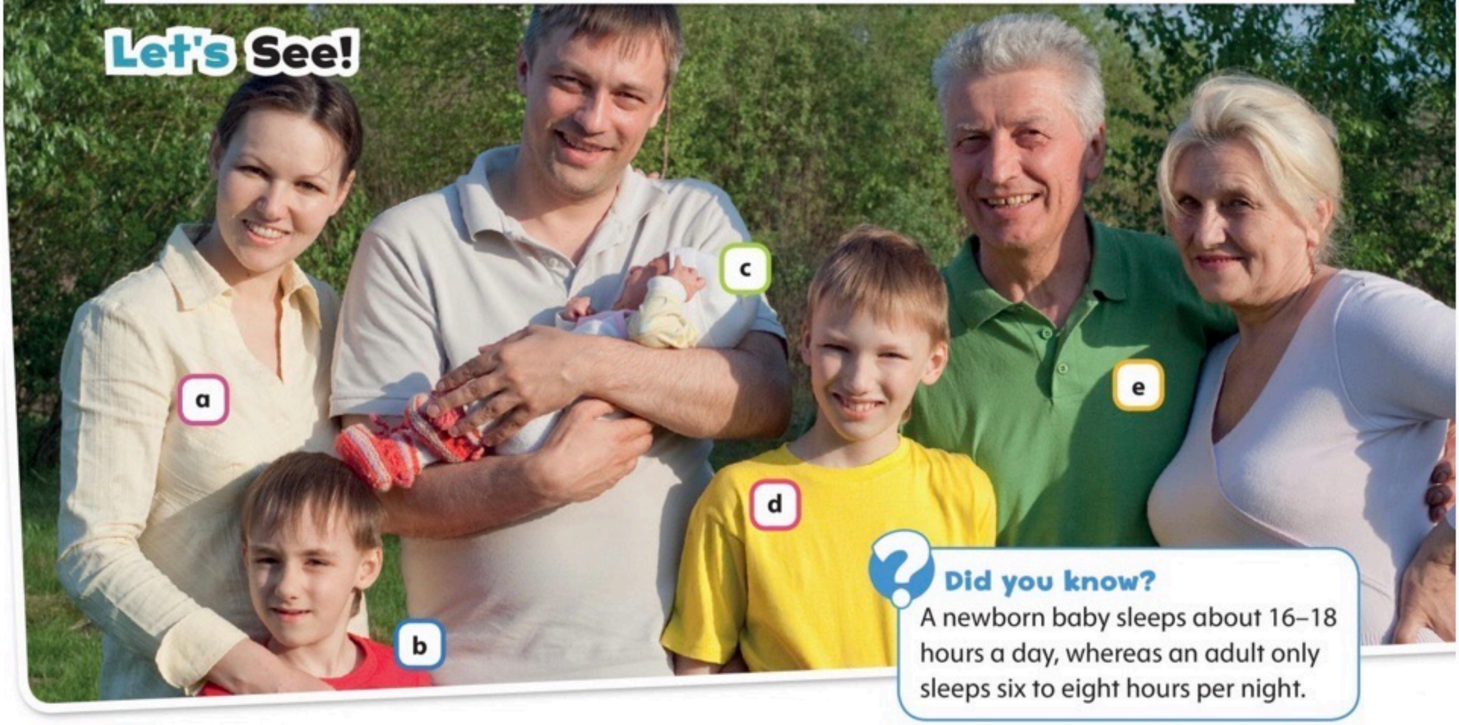
Watch the video ▶

Lesson 1: What are the stages of life?

Learning Goals In this lesson, you will explain the stages and characteristics of human development.

Inquiry Skills You will compare and contrast the key events and features of each stage in the human life cycle.

Let's See!



Did you know?
A newborn baby sleeps about 16–18 hours a day, whereas an adult only sleeps six to eight hours per night.

① **What stages of life can you identify? Match the people to the words.**

☐ infancy ☐ childhood ☐ adolescence ☐ adulthood ☐ old age

② **Compare the infant and the child. Write some differences.**

a The infant can't walk yet, but the child can walk, run, and jump.

b

c

③ **Compare the adolescent, the adult, and the elderly person. Discuss with a partner.**

The elderly person has gray hair. Adolescents can move more easily than elderly people.

Let's Try!

How Do Humans Change During Each Stage of Life?

1 Draw the stage of life chart.

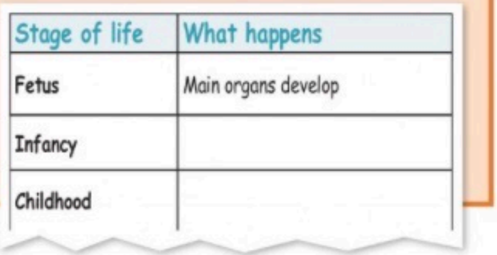
2 Interview your partner about what happens in each stage of life. Write his/her answers on your chart.

3 Why do these things happen in each stage of life? Discuss in small groups.

During ... , you ... because ...

Materials

- One sheet of paper
- A black marker
- A ruler



Stage of life	What happens
Fetus	Main organs develop
Infancy	
Childhood	

Let's Learn!

① Listen and number the paragraphs in the correct order. 5

The Human Life Cycle

1 fetus 2 infancy 3 childhood 4 adolescence 5 ~~adulthood~~ 6 old age

5 When we are fully grown, our strength, coordination, and senses are at their best. However, as we get older, wrinkles develop as the skin becomes less elastic.

☐ Newborn babies react to stimulation without thinking. By their first birthday, most babies are more independent and can make decisions. By 18 months to two years, most babies can walk and talk.

☐ Between the ages of 13 and 19, people transition from children to adults. The body produces hormones that cause changes in our physical characteristics. Girls grow taller, their hips widen, and hair grows on the legs and under the arms. Boys also become taller and stronger, their voices deepen, and hair grows under the arms, on the face, and on other parts of the body.

☐ We begin life in our mother's womb. Human pregnancies last around 40 weeks. In the first trimester, the main organs, facial features, arms, and legs start to form. In the second trimester, the fetus starts to move and kick. In the final trimester, the organs finish developing, and the fetus can open its eyes.

☐ From about age 65, the aging process causes cells to decay, muscle mass to decrease, and the immune system to weaken. Hair is thinner and melanin (the substance that gives hair its color) decreases, turning hair gray or white. Elderly people become shorter because they have less bone density.

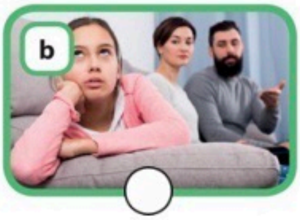
☐ Most girls experience a growth spurt around age nine or ten, and boys around age eleven or twelve. Girls and boys have similar body shapes and proportions until they reach puberty.

2 Listen again and make notes about the key events in each stage of life. Discuss with a partner. 5

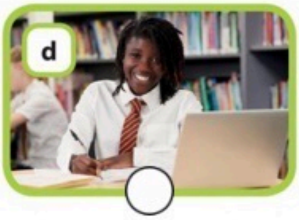
During infancy, we become more independent and learn to walk and talk.

3 Match the pictures to the types of development. Then read and check.

a

b


c

d


physical

intellectual

emotional

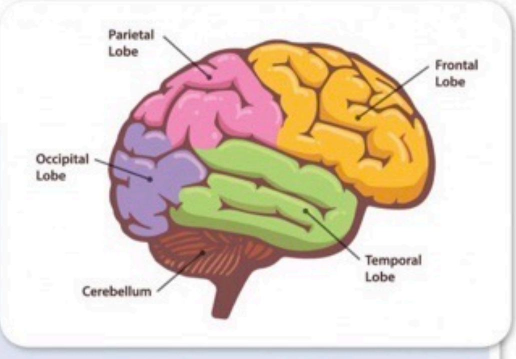
social

Physical development for humans is much longer than other mammals. In childhood, we grow more steadily, but in adolescence we experience growth spurts and a lot of physical changes in a short time. As we grow, our fine and gross motor skills gradually improve. These motions require the brain, nervous system, and muscles to work together. Fine motor skills are small movements, like picking up small objects. Gross motor skills are bigger movements, such as rolling over, walking, or jumping. Our ability to communicate using language, and to store and recall information, are key stages in our intellectual development. The frontal lobe in the brain does not fully develop until we are 20–25 years old. Until this age, we are still developing skills related to planning, memory, and impulse control. This part of the brain is also the first to decline in adulthood. We process information more slowly and our working memory stores less information. Infancy, early childhood, and adolescence are important stages in our emotional development. During these times, humans want to become more independent and are developing their self-esteem. Hormones can create mood swings and extreme emotions, which may cause conflict with family and friends. In adulthood and later life, our ability to process emotions improves and we are able to show more empathy – the ability to understand and share the feelings of others. Social development is learning how to interact with and understand other people. As we grow older, we start to develop close relationships with people outside our immediate family. Social development continues throughout our lives as experience teaches us how to behave in different situations. In adulthood, we also think less about ourselves and learn how to care for others, such as our children or elderly family members.

4 Read again and complete the definitions.

physical	**development:**	Changes in the way we look and the actions and movements we can do.
	development:	Changes in our ability to remember information, communicate, and control our impulses.
	development:	Evolution of self-image and the tools to manage and understand our feelings.
	development:	Growth of relationships with different people in our lives and our ability to interact with others.

5 What happens to the brain during our lifetime? Read and answer.



Change in the Human Brain

We are born with basic survival skills, reflexes, and as many as 100 billion neurons. These neurons get bigger, work more efficiently, and, as a result of environmental input, make trillions of new connections that improve our brain. As the occipital lobe, which controls our vision, develops, our hand–eye coordination gets better.

By two years old, about 85% of brain development has happened, including intellect, personality, and basic motor skills. As the cerebellum continues to grow, our balance and coordination improves. A child's brain has twice as many connections as an adult's brain. In a process called "pruning," the neural connections that are used most often, like those used for language, are strengthened, while the ones that aren't used, die. The parietal lobe, which helps us distinguish size, shape, and color, increases as we learn more about the world around us.

At age 20–25, the brain reaches its adult weight of three pounds. The frontal lobe, which is responsible for impulse control, planning, weighing risks, and decision-making, finally matures and our brain performs at its best. By our late 20s, reasoning, spatial skills, and speed of thought begin to decline. In our 30s, the number of neurons in the brain decreases and our memory does not function as well as before. From our mid-40s to late 50s, the temporal lobe, which controls memory, loses function so we can have difficulty recognizing faces and remembering names. However, the parts of our brain used for identifying right and wrong, controlling emotions, and understanding social situations actually improve in mid-adulthood.

By age 60, the brain has shrunk in size, and after a lifetime of gaining knowledge, it becomes less efficient at accessing that knowledge and adding to it. In older age, there is an increased risk of brain disease, such as Alzheimer's, which results in a fast rate of tissue loss and cognitive decline.

6 Read again and look at the diagram. Complete the sentences with the parts of the brain.

a The ☐ controls balance and coordination.
b The ☐ controls impulses and decision-making.
c The ☐ controls memory.
d The ☐ controls vision.
e The ☐ helps distinguish size, shape, and color.

7 Read again and answer true (**T**) or false (**F**).

a We have the very basic skills needed to survive when we are born. T
b All our neural connections from infancy die before adolescence. ☐
c Our brain finishes developing in early adulthood. ☐
d As we age, our ability to identify right and wrong, and control our emotions declines. ☐

8 **What happens to your body as you age? Discuss with a partner. Then listen and check.** 6

9 **Listen again and complete the text with words from the box.** 6

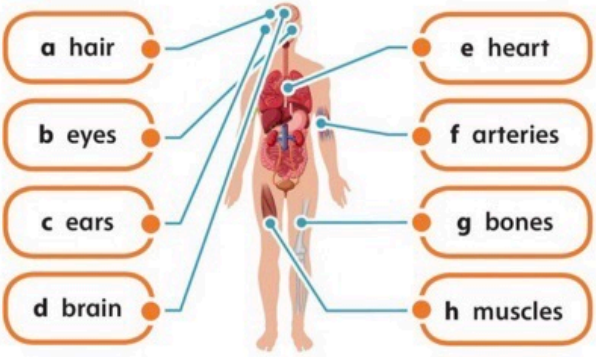
blood	capacity	messages	flexible	diseases	fattydeposits	~~hair~~	lenses	oxygen	sound

The Effects of Age on Our Body

There are many changes to the mind and body during the aging process:

- Our ^{1} ___hair___ starts to turn gray because of a decline in the amount of melanin in our hair follicles, and almost everyone will have some hair loss.
- The ^{2} ______ inside our eyes change with age. They are not able to focus on close-up objects as well as when we were young. There is a greater risk of developing eye conditions, such as cataracts and glaucoma.
- The cells in our inner ear that are responsible for picking up ^{3} ______ waves start to deteriorate as we get older, leading to hearing problems. Other age-related changes contributing to hearing loss include the thickening of the eardrums and thinning of the walls of the ear canal.
- We lose neurons in the brain. There is also a reduction in the amount of certain chemicals called neurotransmitters that send ^{4} ______ to the brain. These changes can cause minor memory problems.
- Our lungs and chest wall become stiffer, resulting in our lung ^{5} ______ declining. The muscles used for breathing also become weaker, and we start to absorb slightly less ^{6} ______ from the air.
- Our heart muscles become less efficient at pumping ^{7} ______, the walls of the heart become more rigid, and it takes longer for our heart to fill with blood. This affects our stamina and endurance, and also increases the risk of heart attacks and heart ^{8} ______.
- Our arteries' walls become thicker. ^{9} ______ can begin to appear inside the arteries, making the passageway for blood flow narrower. These changes can cause high blood pressure.
- Bone density decreases so bones can break more easily. From as young as 30, our muscles can start to get smaller and lose strength. We may also find that our muscles are less ^{10} ______.

10 **Match to complete the sentences. Read and check.**



☐ a changes color
☐ become less flexible
☐ may develop cataracts and glaucoma
☐ become narrower
☐ pick up fewer sound waves
☐ loses neurons
☐ takes longer to fill with blood
☐ lose density and become weaker

Let's Do It!

1 **Complete the chart with the life stage each key event relates to.**

Key Event	Life Stage
Strength and coordination are at their best.	adulthood
Language and motor skills start to develop.	
Hormones cause growth spurts and mood swings.	
Organs and facial features form.	
Cells decay and the immune system weakens.	
Growth is steady; limbs become long and lean.	

2 **Complete the sentences with words from the box.**

tall ~~coordinated~~ efficiently strong

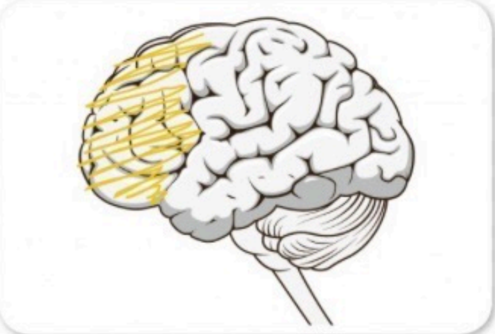
a A child isn't as coordinated as an adult.

b A teenager can be as as an adult, but their brain is not as well-developed.

c In old age, our organs don't work as as they did when we were younger.

d After 30 years old, our muscles are not as and flexible.

3 **Use the key to color the brain diagram.**



🟨 frontal lobe: impulse control

🟦 occipital lobe:

🟩 parietal lobe: size, , color

🟥 temporal lobe:

🟧 cerebellum: , coordination

4 **Complete the information in the key in activity 3 with words from the box.**

vision balance memory ~~impulse control~~ shape

5 **How will your brain change as you get older? Why? Explain to your partner.**

At age ... , the ... will mature. This means our ... skills will improve.

Let's Show It!

1 Complete the chart in your own words.

Physical Development	Intellectual Development	Emotional Development	Social Development
Changes in the way our body looks and moves	How we learn and gain knowledge of the world around us		

2 Complete the sentences with words from the box.

arteries ~~eyes~~ hair hearing problems lungs

a We develop cataracts and glaucoma in our ____eyes____ .

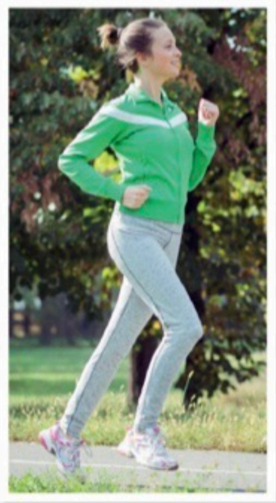
b Our ____ are not as efficient and absorb less oxygen.

c We lose our ____ and it turns a different color.

d Thickening of the eardrums causes us to develop ____.

e It is more difficult for blood to flow when fatty deposits make the ____ narrower.

3 In pairs, compare how life will be different when you are 20, 40, 65, and 80 years old. Discuss with a partner.



When we are 65, our ... won't be as ... as before. This means we will ...

Project

Do Other Mammals Go Through Complex Changes and Developments in Their Lives?

In this project, you will compare and contrast the changes and developments that other mammals go through in their lifetime.

Stage 1: Plan your project

1. In groups, choose three different species of mammals.
2. Decide who will do research on each species.
3. Write questions to help you guide your research.

Does this species have a similar life cycle to humans?

What happens to the body in each life stage?

How does the aging process affect this species?

What care do these animals need throughout their lives?

Stage 2: Develop your project

1. Make a chart to organize your ideas.

Species Name	1	2	3
Life cycle stages			
Changes to the body in each life stage			
Effects of the aging process			
Needs and care throughout life			

2. Do your research in the library or on the Internet. Record your data.
3. Share your data with your group.
4. Analyze your data. Does this species have a similar life cycle to humans? Why?

UNIT 2

How Do We Change and Develop During Our Lifetime?

Lesson 2: How can we care for people throughout their lifetime?

Learning Goals In this lesson, you will describe the relationship between human needs and the provision of care throughout the life cycle.

Inquiry Skills You will also put items in a progressive order.

Let's See!

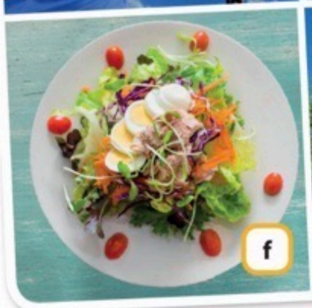
a

b

c

d

e


f

g

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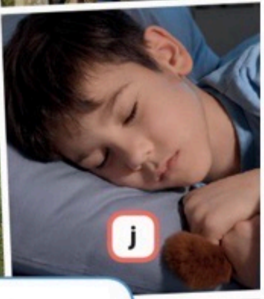
i


j

Did you know?
Humans can survive three weeks without food, but only three to four days without water.

① **Match the pictures to the human needs. Then, circle the basic needs for survival.**

i acceptance and respect ☐ clothing ☐ education ☐ family ☐ food
☐ physical activity ☐ shelter ☐ sleep ☐ water ☐ friends

② **What is the difference between the basic needs and the other needs in activity 1? Discuss with a partner.**

③ **List the needs in order of importance. Discuss with a partner.**

I think … is the
most important because …

Let's Try!

How Are Human Needs Similar and Different During Childhood and Adulthood?

1. Draw a similarities and differences chart.
2. Work with a partner and decide which human needs are the same and different in childhood and adulthood.
3. Discuss in groups. Write your ideas in the chart.

Materials

- One sheet of paper
- One ruler
- One black marker

Do children and adults both need ... ?

Human needs in childhood and adulthood	
Similarities	Differences
Both children and adults need food and water	

Let's Learn!

① **What are psychological human needs? How do we satisfy these needs? Discuss with a partner. Then read and check.**

Six Psychological Needs

Basic human needs are those that are necessary for our survival. However, we have other types of needs. Psychological needs are those which help our brain and mind grow, and influence our behavior, development, and motivation. Psychologists have identified six psychological needs:

1 Certainty : Humans need security, comfort, order, protection, and control.

2 ☐ : There are times when change is important. New and different experiences help us to expand and develop our personalities.

3 ☐ : Humans need to feel acceptance and respect. They make us want to be useful members of society.

4 ☐ : Human touch is essential for babies and young children to develop correctly.

5 ☐ : To create and maintain connections in the brain, we must always learn new things and practice our skills.

6 ☐ : Feelings of empathy drive humans to want to help, support, and care for others.

② **Read again and match the psychological needs to the paragraphs.**

Significance   Love and Connection   ~~Certainty~~   Contribution   Variety   Intellectual Growth

3 Look at the pyramid. What do you think it shows? Discuss with a partner.

I think it shows ...

4 Listen and check your answer to activity 3. Then listen again and complete. 7

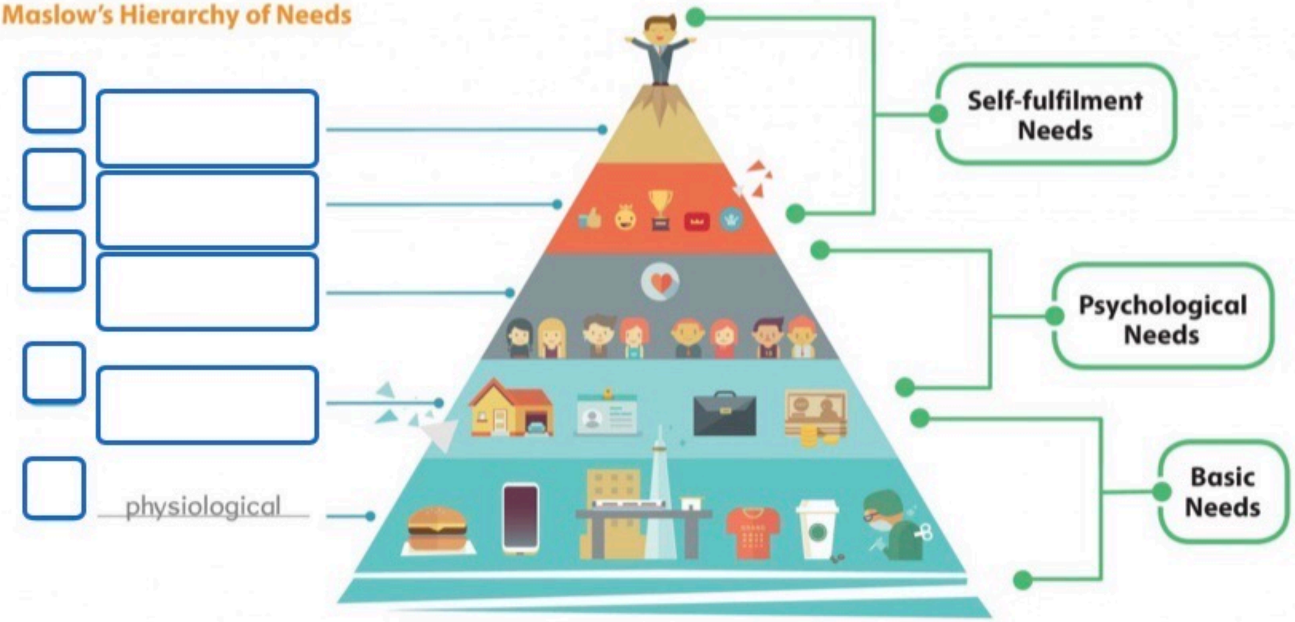
Maslow's Hierarchy of Needs

Maslow's Hierarchy of Needs is a pyramid showing the five layers of human needs. The bottom two layers show our ^{1} ___basic___ human needs. Maslow calls the first layer physiological needs. These are the things we need to survive: air, food, water, warmth, sleep, shelter, and clothing. Once those needs are met, humans are able to focus on satisfying the next level of basic needs: the safety needs. These include ^{2} ______, good health, and employment.

The third and fourth layers show our psychological needs. Maslow calls the third layer our belonging needs. These are the needs we have to feel loved by our ^{3} ______ and family, and to feel like we are part of a community. The fourth layer shows our esteem needs. This is our need for recognition and ^{4} ______ from others.

Finally, at the top of the pyramid, is our need to be the ^{5} ______ person we can be. This is called self-actualization or self-fulfilment. We can only achieve our full potential when all our needs on the lower levels of the pyramid have been satisfied.

Maslow's Hierarchy of Needs



5 Label each layer of the pyramid with words from the text.

6 Number the needs in the order they must be satisfied. Tell a partner.

First, a person needs to satisfy their physiological needs, like ... Then, ... After that, ... Finally, ...

7 Look and write the needs in the correct place.

Basic Needs

warmth

Psychological Needs

Self-fulfilment Needs

8 Look and circle the people who care for you.

a

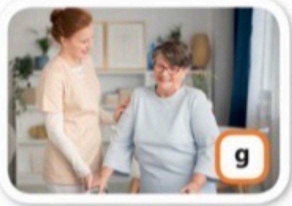
b

c

d

e

f



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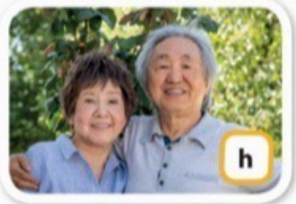


h

9 Complete the chart for the people you circled in activity 8.

Person	How do they care for you?	What human needs do they help you satisfy?
teacher		

10 How do our caregivers change depending on the stage of life? Discuss with a partner.

When I was younger, my … cared for me. When I'm older, I might need a … to care for me.

11 **Do newborns and children have the same needs? Read and discuss with a partner. Listen and check.** 8

Humans need some kind of care during every stage of life. As a fetus in the womb, our mother's body provides for all our needs through the umbilical cord, which gives us oxygen and nutrients.

Compared to other animals, the brain of a newborn human is very underdeveloped, so babies need 24-hour care and can't walk or feed themselves for many months. Caregivers must provide for all their basic and psychological needs. All babies are born with the need for physical contact, and to feel safe and loved. A strong emotional connection between a baby and its main caregiver produces hormones which improve brain development, and help a person build successful relationships in adulthood.

By childhood, humans develop language skills and can communicate their needs to their caregivers. However, children still need someone else to satisfy most of their basic needs. Caregivers are also important for a child's intellectual growth and social skills. By copying an adult, children learn how to behave and interact with others.

In adolescence, humans become a lot more independent, but still need a safe home environment to develop their self-esteem. Relationships with caregivers outside the home, such as friends, teachers, and other adults, become more important as we develop our own identity, separate from our main caregivers.

During early adulthood, humans become fully independent. However, we still need other people to satisfy all our needs. For example, we see a doctor when we are sick; teachers and employers help us learn; and family and friends make us feel loved and accepted.

In old age, our muscles and bones decline, which causes a loss of gross motor skills, strength, and flexibility. We may need a caregiver to support us with physical tasks, such as getting dressed and bathing. As the brain declines, we may experience confusion and memory loss. This can also impact our care needs.

12 **Listen again and make notes about human care needs at each stage of life.** 8

Mother gives food, oxygen
through umbilical cord

Let's Do It!

1 **Match the caregivers to the main needs they help us to satisfy.**

○ **a** good health

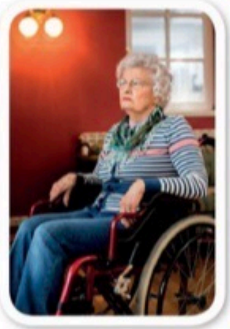
● **b** learning, belonging, recognition, self-esteem

○ **c** food, water, shelter, clothing, love, belonging, self-esteem

○ **d** belonging, self-esteem, emotional connections

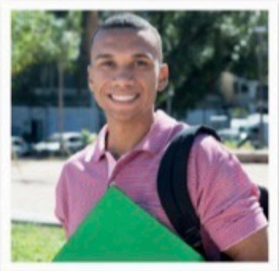
2 **Compare the care needs of these two people. Why do they have these care needs?**

Newborn babies need 24-hour care because their brains are not fully developed. This means they can't walk or feed themselves.



3 **Luis is training to be a care worker. Help him understand the different human care needs at each stage of life and who usually satisfies those needs. Complete the chart in your own words.**

	Basic Needs	**Psychological Needs**
Fetus	oxygen, food (mother)	None
Infancy	food, water, shelter (main caregiver)	love, physical contact, emotional connection (main caregiver)
Childhood		
Adolescence		
Adulthood		
Old Age		



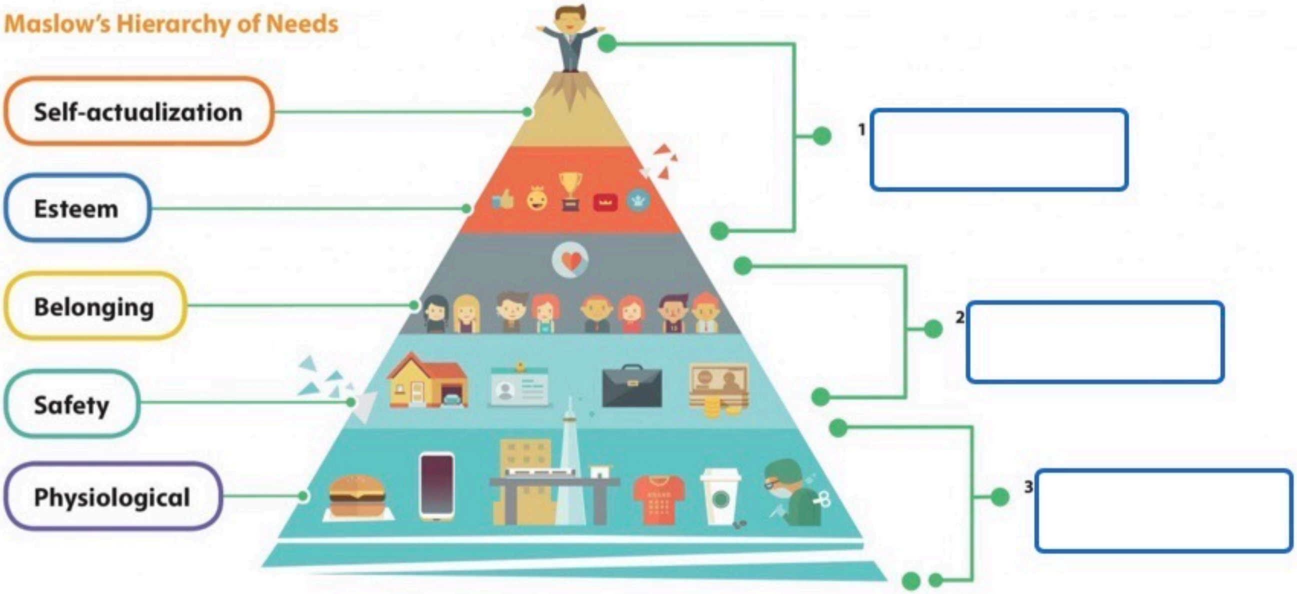
Let's Show It!

1. Write a definition for each of the six psychological needs.

Psychological Need	Definition
Certainty	The need for safety, protection, and control.
Variety	
Significance	
Love and Connection	
Intellectual Growth	
Contribution	

2. Label the Hierarchy of Needs pyramid using the words in the box.

Psychological Needs   Self-fulfilment Needs   Basic Needs



3. Use the sequencing words in the box to describe Maslow's Hierarchy of Needs.

~~First~~   Then   After that   Finally

First, humans must satisfy their physiological like food, water, and shelter.

Then, they must ...

Project

Do Other Mammals Go Through Complex Changes and Developments in Their Lives?

In this project, you will compare and contrast the changes and developments that other mammals go through in their lifetime.

Stage 3: Share your project

1. **Use the chart from stage 2 on page 25. Create a poster.**
    - **a** Divide a poster board into four columns.
    - **b** Write the facts you gathered from research about the life cycle, and the needs and care for each species. Use the last column for the information you learned in this unit about human beings.
2. **Present your project to the rest of the class.**
    - **a** What aspects of the life cycle and needs and care of the four species are similar or different?
    - **b** Which species live the longest? Why?

According to research, ... live the longest because ...

Stage 4: Evaluate your project

1. **Ask your classmates to evaluate your presentation.**
    - **a** Is the information clear?
    - **b** Do you make eye contact with your audience when you speak?
    - **c** Do you give your audience time to ask questions at the end of your presentation?
    - **d** Are there any spelling or punctuation mistakes on your poster?
2. **What did you learn from your research and presentation? What would you do differently?**

UNIT 2

Unit Review

1. Go back and watch the video ▶
2. Now complete the activities on your **Video Worksheet**

What Have You Learned?

① **Go back to page 1. Write more words for each picture. Which picture has the most words?**

② **Discuss these questions.**

What happens if I don't keep a healthy weight?

How do we change and develop throughout our lifetime?

Do You Want to Know More?

Find out about five ways to a healthy lifestyle:
https://www.healthykids.nsw.gov.au/kids-teens.aspx

Play games, get activity cards, and get ideas to keep a healthy weight at this site:
http://www.cdc.gov/bam/activity/index.html

Learn more about the human life cycle and do fun worksheets at this site:
https://k8schoollessons.com/human-life-cycle/

Learn more about human needs at this site:
https://www.simplypsychology.org/maslow.html

BLOCK 2

The Environment

Find words for each picture.

Body Mass Index (BMI) movement
habitat destruction
logging
sustainable communities
metabolism
regulating services
manure
soil
mulch
forest
desert
grassland
freshwater
marine
habitat loss
scarcity
high blood pressure
wildfires
unicellular
cultural services
horizons
sustainable agriculture
3Rs (reduce, reuse, recycle)
reproduction
biodiversity
biotic factors
compost
grazing
crops
livestock
smart growth
biomes
tundra
flood
archaea
plantae
climate
eukaryotae
bacteria
urban sprawl
habitat degradation
landslides
growth
acellular
trawling
topsoil
animalae
fungi
dam
prokaryotae
supporting services
protista
development
gyres
abiotic factors
irritability
multicellular
endangered species
provisioning services
endemic species
viruses
habitat fragmentation
soil erosion
invasive species

UNIT 1

What Will Happen If We Don't Protect Our Ecosystems?

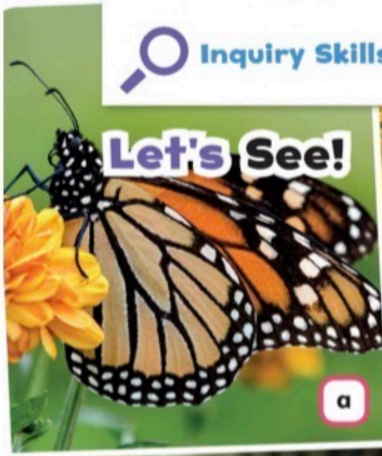
Watch the video

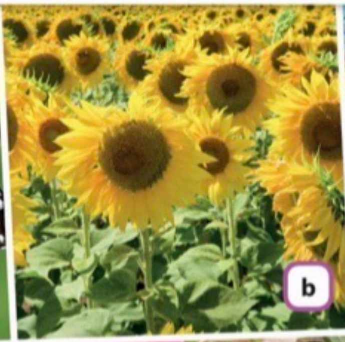
Lesson 1: Why is biodiversity important?

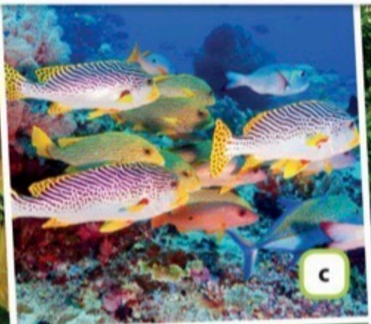
Learning Goals In this lesson, you will recognize the varieties of living organisms on Earth and explain the importance of biodiversity.

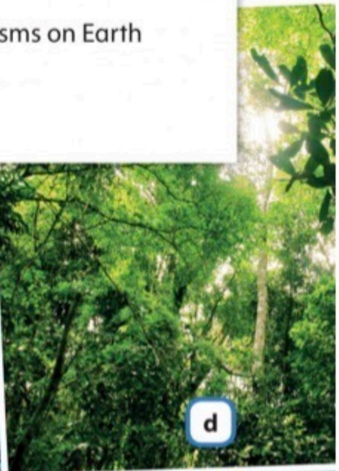
Inquiry Skills You will also communicate in a debate.

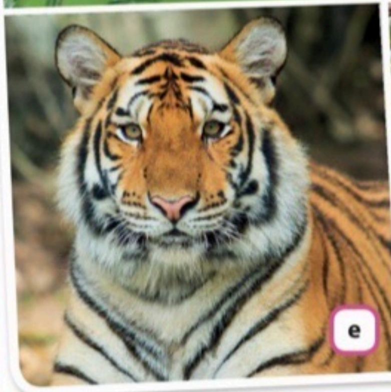
Let's See!

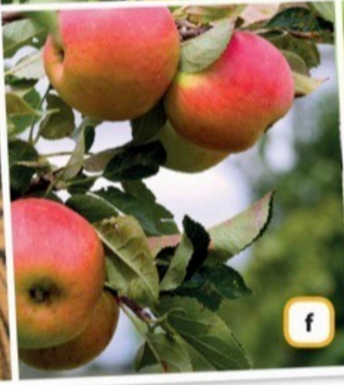


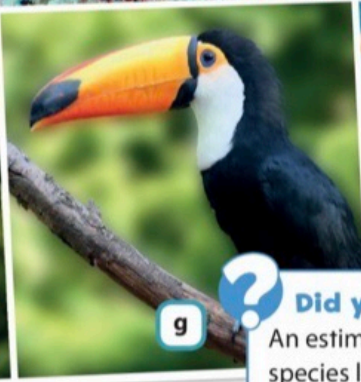


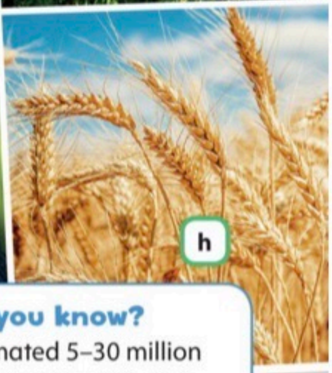












Did you know?
An estimated 5–30 million species live on Earth, but only about 1.9 million have been identified by scientists.

① **What living things can you see? Match the pictures to the words.**

Living Things			
Animals		Plants	
☐ butterfly	☐ tiger	☐ trees	☐ sunflowers
☐ toucan	☐ fish	h wheat	☐ fruit

② **What nonliving things can you see? How do you know they are nonliving? Discuss with a partner.**

I found ... in picture ... I know they're nonliving things because ...

Let's Try!

Is There a Great Variety of Living Things?

Materials

- One sheet of paper
- Colored markers

1 Draw a picture of your favorite park. Include all the living and nonliving things that you remember.

2 Make a classification chart in your notebook.

3 Exchange drawings with your partner and classify what you see.

4 Did you find many different living things or more nonliving things? Why? Discuss with your partner.

Classification Chart

Living	Nonliving	Not sure
shrubs		

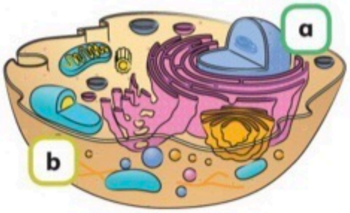
I found many / not many different living / nonliving things because ...

Let's Learn!

① **Are all cells the same? Read and answer.**

Cells

A cell is the most fundamental structure of a living thing. Some living things are unicellular. That is, they have only one cell. Other living things are made up of many cells. They are multicellular. But, not all cells are the same. Plant cells and animal cells are different. Even within the same organism, cells can differ in structure and function. For example, in human beings, muscle cells and lung cells are different because they perform different functions. Despite the differences, they do have elements in common like a membrane, which surrounds and protects the cell, and a nucleus with chromosomes.



The cells are / are not different because ...

② **Read again and write the letter.**

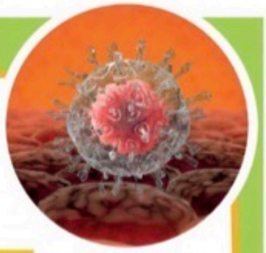
☐ cell membrane ☐ nucleus

③ **Are human hair cells and skin cells different? Why? Discuss with a partner.**

4 **Read and complete the article with words from the box.**

survival (x2) organisms ~~characteristics~~ ability outside living share things

What's All the Fuss About Life?



Defining life is very complex. Even scientists find it difficult to agree on a specific list of [1] characteristics to describe life. However, there are certain similarities that all living things [2] ______. We know, for example, that all living things are made of one or more cells. Other characteristics that living things have are reproduction, metabolism, growth, development, irritability, and movement. Reproduction refers to the capacity of an organism to produce another organism of the same type, which is essential for the [3] ______ of a species. But, metabolism is essential for the [4] ______ of a single organism. This means that all living [5] ______ use energy from the environment as a form of nutrition. Also, all living things present irritability, or the [6] ______ to react to their environment, such as to changes in temperature or other stimuli.

There are, however, more disagreements among scientists. There are microbes that scientists don't agree on whether they are [7] ______ things or not. Those are called viruses. Viruses don't have cells. They are acellular. They depend on living [8] ______, called hosts, to grow and multiply. Viruses exist in two different states. When they come in contact with the appropriate host, they become active. In this state, a virus behaves like a living thing: it reacts to its environment and reproduces. When they are [9] ______ a host, they are inactive.

5 **Read again and complete the debate chart with words from the text.**

Debate Topic: Viruses Are Nonliving Things

Statement	Relevance		
	Fact	For	Against
Viruses are acellular and can only be ______ inside a living cell.	✓	✓	
Viruses are unable to grow and multiply outside a ______.	✓	✓	
Viruses are acellular, but they can react to their environment and reproduce.	✓		✓

6 **Form two debate groups and select a mediator. Use information from the text in activity 4 and the debate chart in activity 5 to present and defend your argument.**

Viruses are nonliving things because they ...

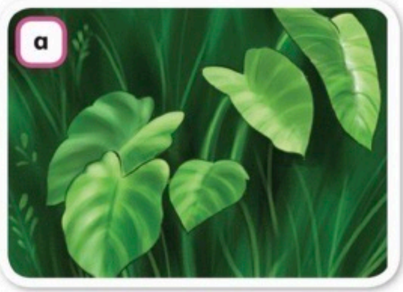
However, viruses present characteristics of life because they ... Therefore, they ...

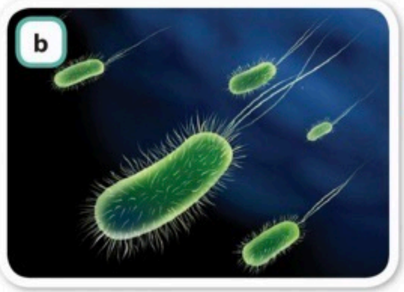
7 What is biodiversity? Write true (*T*) or false (*F*). Then listen and check. 🔊9

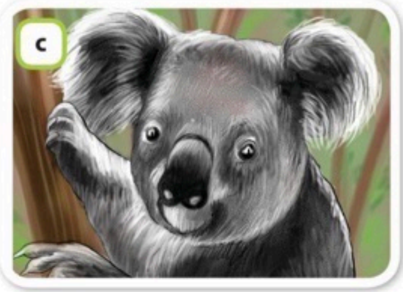
☐ **Biodiversity** is the term used to describe the variety of life forms found on Earth.

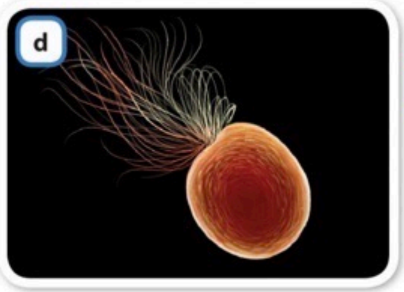
8 Listen again. Match the pictures and complete the chart with **unicellular** or **multicellular**. 🔊9

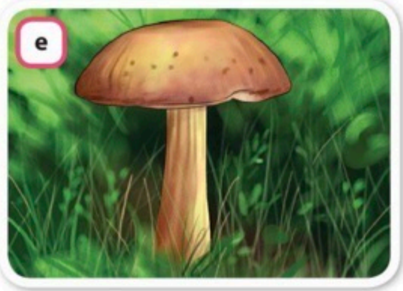
- **Living things**
  - **Prokaryotae**
    - b **Bacteria**
      1 unicellular
    - ☐ **Archaea**
      2 ______
  - **Eukaryotae**
    - ☐ **Protista**
      3 ______
    - ☐ **Fungi**
      4 ______
    - ☐ **Plantae**
      5 ______
    - ☐ **Animalae**
      6 ______

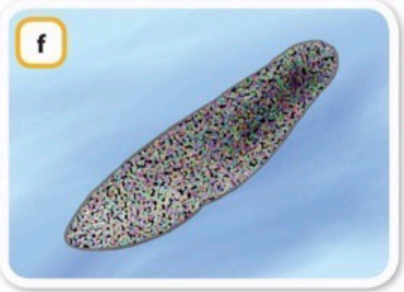








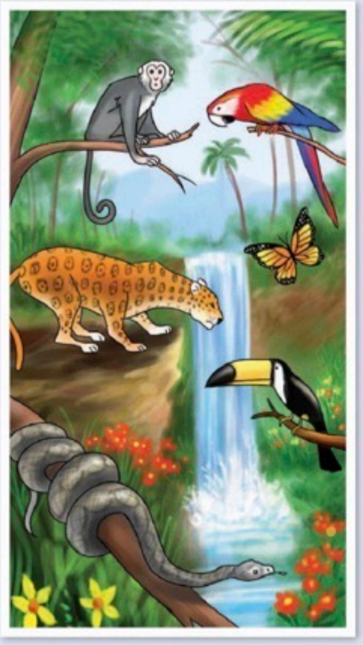




9 In small groups, do research on the classification of living things. Write statements for and against the debated topics. Make a debate chart in your notebooks and organize your arguments.

10 What do living things need to survive? Discuss with your partner. Then read and check.

Living things need ... to survive because ...



Biotic and Abiotic Factors

There is an enormous variety of living things on Earth. This biodiversity is the product of a great range of species that live in ecosystems. But, ecosystems are controlled by factors that can affect biodiversity.

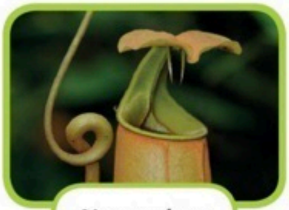
Biotic factors are all the living things within an ecosystem that depend on one another in some way. Abiotic factors are the nonliving components that support an ecosystem. Some of those factors are air, water, light, and soil. Abiotic factors are extremely important because they provide the necessary elements for organisms to grow, develop, and reproduce. Some abiotic factors provide shelter, or habitat, to living things. We can say that ecosystems that are the richest in biodiversity are those with an abundance of abiotic factors. This richness in biodiversity provides the support for species to adapt to and survive sudden or drastic changes.

11 Read again and circle some biotic and abiotic factors you find in the picture. Then complete the chart.

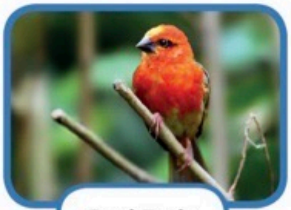
Biotic Factors	Abiotic Factors
parrot	water

Let's Do It!

1 Classify some of the living things that populate the island of Madagascar.


Nepenthes

Lemur


Red Fody

Baobab

Eukaryotae	
Animalae	**Plantae**
Lemur	

2 Read and complete. Then listen and check. 10

destruction shelter ~~biodiversity~~ estimate world forest

Madagascar is the fourth largest island in the world and the place with the richest [1] biodiversity. As a matter of fact, about 80% of the species in Madagascar can't be found anywhere else in the [2] ______.

An ancient type of agricultural practice called "tavy" has led to the [3] ______ of an estimated 90% of the island's forest.

Scientists estimate that 1–2% of the [4] ______ continues to be destroyed every year. They also [5] ______ that 32 different types of lemurs inhabit the island. And, forest trees provide the lemurs and other animals with [6] ______ and food.

3 Listen again and complete the debate chart. 10

Debate Topic: The Malagasy Must Stop Clearing Land for Agriculture.			
Statement	**Relevance**		
	Fact	**For**	**Against**
90% of the island's forest has been destroyed.	✓		
			✓
		✓	

Let's Show It!

1. Classify the words related to living things.

irritability unicellular animalae multicellular protista reproduction fungi
growth archaea plantae development metabolism movement ~~acellular~~ bacteria

Cells	Characteristics of Life		Living Things Classification	
acellular				

2. What biotic and abiotic factors are there in the ecosystems? Complete the chart.

Biodiversity			
Hot, Dry Desert	Coral Reef	Forest	Cold Desert
			biotic: penguins
abiotic: sand			

3. Do research on hot, dry deserts and complete the chart.

Debate Topic: Hot, Dry Deserts Are Not Rich in Biodiversity.			
Statement	Classification Chart		
	Fact	For	Against
About 500 different species can populate a hot, dry desert.	✓		
		✓	
			✓

4. In pairs, choose a statement for or against the debated topic. Present and defend your argument.

Hot, dry deserts are not rich in biodiversity because …

However, hot, dry deserts … because … Therefore, they …

Project

What Native Species in My Country Are Endangered?

In this project, you will discover if there are endangered native species in your country.

Stage 1: Plan your project

1. **In small groups, search on the Internet or in a library for endangered native species in your country. You may conduct a search at this site: http://www.iucnredlist.org**
2. **Choose one species and find two more sources of information.**
3. **Make a chart to organize your research.**

Endangered Species			
Species Name	Leopard Frog	Classification	Animalae
Sources	The ICUN Red List	Source 2	Source 3
Facts	1 Abiotic factor: pools of water 2 No population information 3 Endangered because of drought		

Stage 2: Develop your project

1. **Do your research in the library or on the Internet. Record the following data:**
   - **a** Classification of the species. You may search at this site: **http://www.ucmp.berkeley.edu/help/taxaform.html**
   - **b** Abiotic and biotic factors that the species needs for survival.
   - **c** What factors present a threat to the survival of this species? Share your data and discuss with your partners.

The factors that present a threat to the survival of this species are … because …

UNIT 1

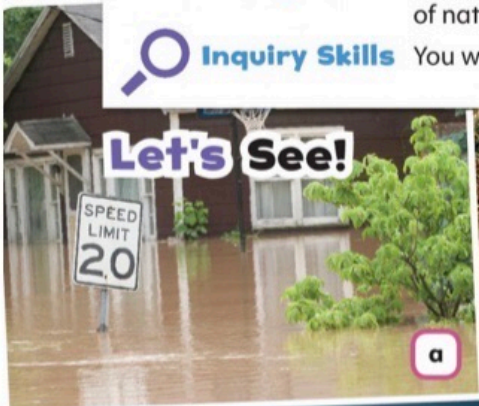
What Will Happen If We Don't Protect Our Ecosystems?

Lesson 2: What happens when a region loses its native plants and animals?

Learning Goals In this lesson, you will identify endemic species and the consequences of loss of native plants and animals in a region.

Inquiry Skills You will also predict results based on trends.

Let's See!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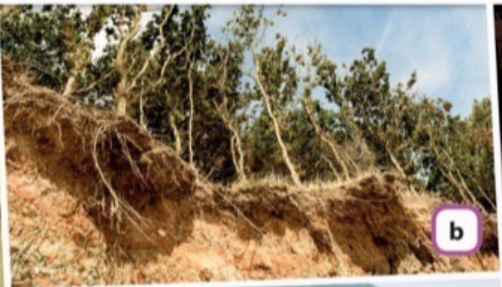
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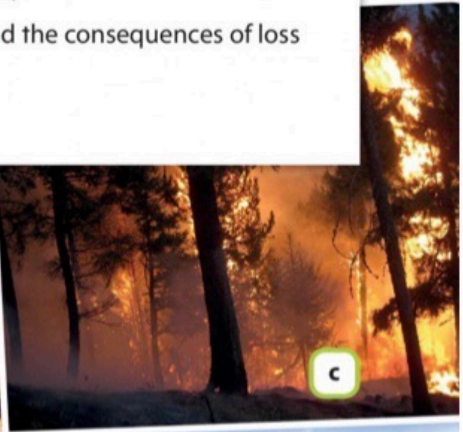
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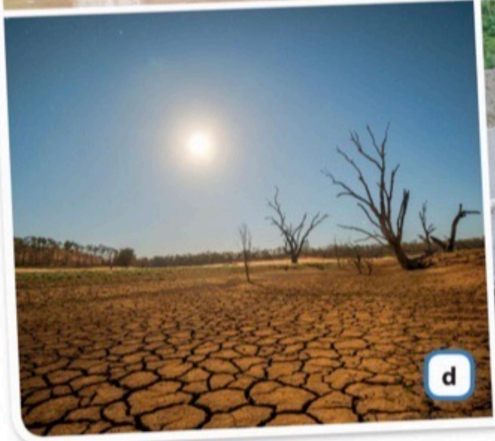
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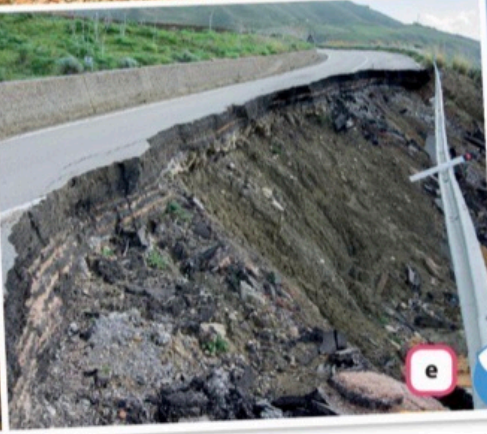
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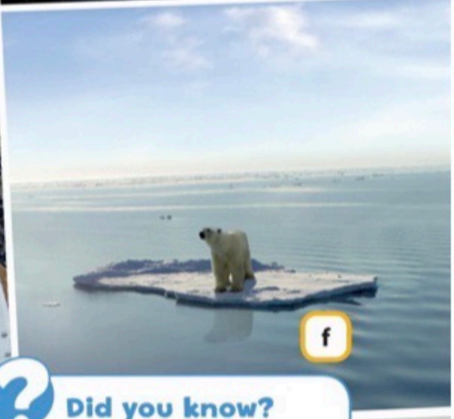

f

Did you know?
Scientists estimate that up to 100 species become extinct every year.

1 What disasters can you see? Match the pictures to the words.

☐ drought ☐ soil erosion ☐ melting ice
☐ wildfire e landslide ☐ flood

2 Which of the disasters has the worst impact on biodiversity? Discuss in small groups.

... has the worst impact on biodiversity because ...

Let's Try!

What Happens When Structures Are Built in an Ecosystem?

1 In small groups, draw a forest or a jungle. Include many different plants and animals.

2 Exchange posters with another group.

3 Draw a road and three houses on the poster with the black marker.

4 How many plants and animals disappeared? What happened to the ecosystem? Discuss in small groups.

Materials

- One poster board
- Colored markers
- One black marker

The ecosystem was ... after placing the road and houses because ...

Let's Do It!

① **Why are native plants and animals important? Discuss with a partner. Then read and check.**

Native plants and animals are important because ...

Endemic Species

Ecosystems are a complex network of relationships between abiotic and biotic factors. Every element in an ecosystem is important. Endemic species, also called native species, are those living things that can only be found in a geographical region of the planet and nowhere else. They have successfully adapted to the climate and soil conditions of their region. However, if they or their ecosystem's resources are overexploited for human use, their population in the wild can decrease to the point of making them endangered species. The number of individual members of an endangered species is so small that they can easily disappear from the planet altogether without protection. And, because species depend on one another for survival, if one species disappears, other species can begin to disappear until the whole ecosystem is destroyed.

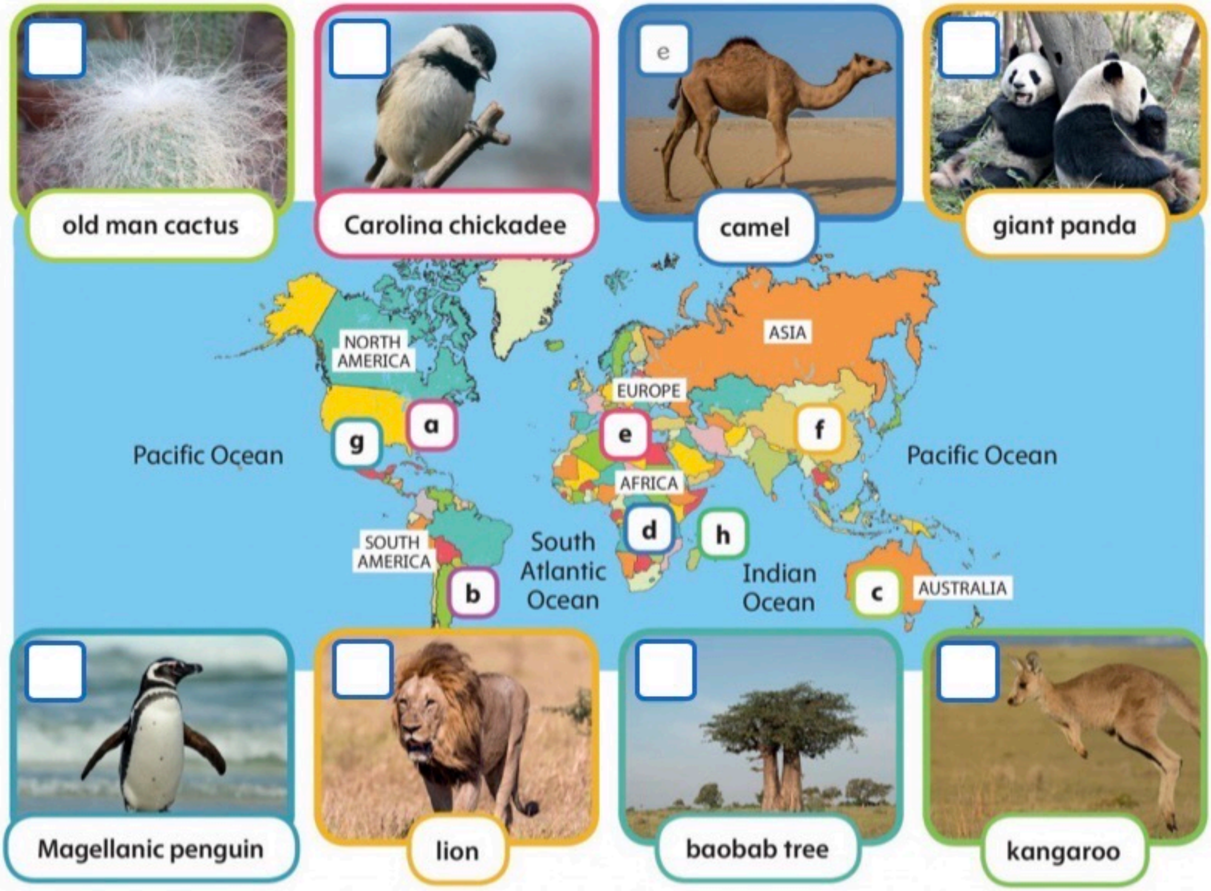
② **Read again and complete the chain reaction diagram.**

Resources in the ecosystem are [1] overexploited for human use.

The population of endemic species in the wild becomes so small that they begin to [2] ☐.

Eventually, the whole ecosystem is [3] ☐.

3 Match the endemic species to their region. Then listen and check. 11



4 Listen again and complete the chart. 11

Endemic Species			
Name	**Location**	**Habitat**	**Food**
	China		bamboo

5 Read and complete. There is an extra word.

bamboo ~~endemic~~ decrease endangered increase

The giant panda is [1] endemic to southwestern China. Pandas are an [2] ________ species because there is a small population of about 1,600 pandas in the wild. They depend mostly on [3] ________ for their survival. If the trend of destruction of bamboo forest areas continues, the current panda population in the wild will [4] ________ significantly.

6 Read and complete the three posts to *Bioworld* online magazine with the words from the box.

activities trees degrade roads ~~shelter~~ paper light pesticides

Why Are Species Endangered Around the World?

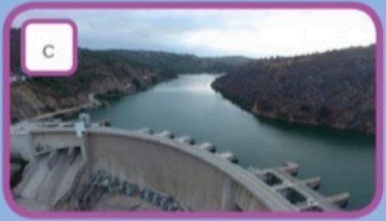
Last month we began the quest for reasons why species are endangered in many parts of the world. Today, we present the three most convincing posts on habitat loss.

a Javier, 28, biologist from Costa Rica

Habitat destruction is the condition that threatens species the most because they lose the 1 shelter , food, and environment needed for survival. As a consequence, it creates biodiversity loss. This tends to be caused by logging or the cutting of 2 ______ for building materials, furniture, or for manufacturing 3 ______ and cardboard products, as well as clearing up land for agriculture.

b Aidee, 37, activist from Jordan

Habitat degradation happens when the quality of an ecosystem is ruined by soil, air, water, sound, and 4 ______ pollution. Light pollution affects nocturnal and other species whose life rhythms are guided by light. Also, agriculture tends to 5 ______ an ecosystem because of the use of 6 ______ and fertilizers. And, invasive species, those not native to an ecosystem, like cattle, consume the resources available.



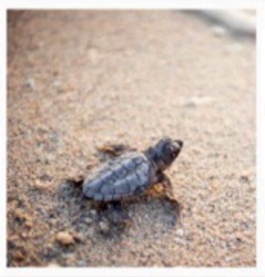
c Mariana, 34, biologist from Mexico

Habitat fragmentation refers to the division of habitats into fragments, which is caused by building a dam, placing nets fo massive fishing, or trawling, building 7 ______, railroad tracks, houses, and structures in urban sprawl. These human 8 ______ divide the populations and make it hard for species to reproduce or roam the environment in search of food and habitat.

7 Read again and match the pictures in activity 6 to the posts.

8 Read and complete.

After they hatch, baby sea turtles instinctively move away from the dark and go in the direction of the light reflected on seawater. However, the strong artificial lights used by hotels are creating habitat 1 ______ because those lights confuse baby sea turtles and make it impossible for them to reach the seawater to survive. If this trend continues, the population of sea turtles is likely to 2 ______.



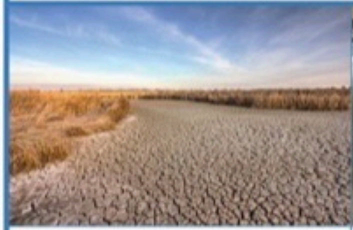
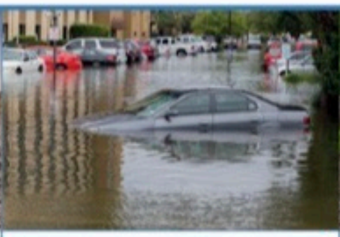
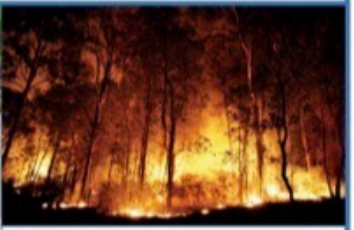
9 What happens to an ecosystem when the population of endemic species declines or is lost? Discuss with a partner. Then read and check.

> When the population of endemic species declines or is lost, an ecosystem may ...

Consequences of Biodiversity Loss

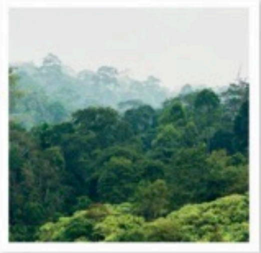
The greatest identified threat to ecosystems and biodiversity is habitat loss. And, the consequences of biodiversity loss to humans, wildlife, and the environment can be devastating. Soil erosion is one of those consequences and it happens when plant ground cover is lost. Without plants, the soil loses its ability to hold water and becomes dry, and it can also produce landslides. Those happen when the side of a hill or mountain slides down and leaves a lot of destruction behind. Also, without the necessary moisture that plants hold, wildfires can be ignited by lightning. The opposite type of consequence is a flood. Floods occur when heavy rainfall or the melting of snow and ice overwhelm the soil's capacity to absorb water. Swamps and marshes provide the environment with a natural response to heavy rainfall because they can hold a lot of water. But, they are frequently drained to convert the land for human use, which leaves the area unprotected. While human activities are intended to satisfy people's needs, exploitation of the environment that leads to biodiversity loss can create scarcity. This means that when endemic species are lost, fewer resources are lost, fewer resources are available within an ecosystem for the survival of other species and for human beings.

10 Read again and complete the chart.

Consequences of Biodiversity Loss			
			
		landslide	

11 What can happen to an ecosystem where constant logging takes place? Write your predictions.

Let's Do It!



① Albert has bought some land in a rainforest so that he can start his coffee plantation. He is planning on cutting trees and clearing land to plant coffee. But, he wants to do it one section at a time. What impact can this have on the ecosystem? Discuss with your partner.

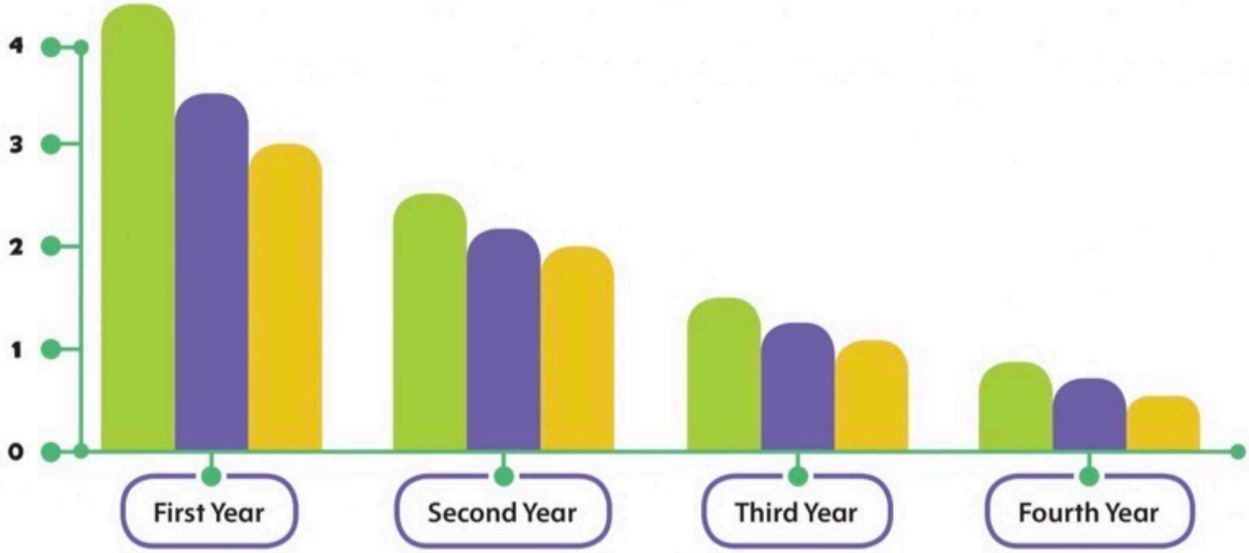
Cutting trees one section at a time can ...

② Complete the chart with information on habitat loss to help Albert make decisions.

Habitat Loss

Habitat Destruction	Habitat Degradation	Habitat Fragmentation
	Constant use of fertilizers or pesticides will ruin the quality of the ecosystem as it pollutes the soil, water, and air. This will threaten endemic species.	

③ The bar chart presents the trend of biodiversity loss according to Albert's logging plan. Predict some results based on that trend. Write your predictions.



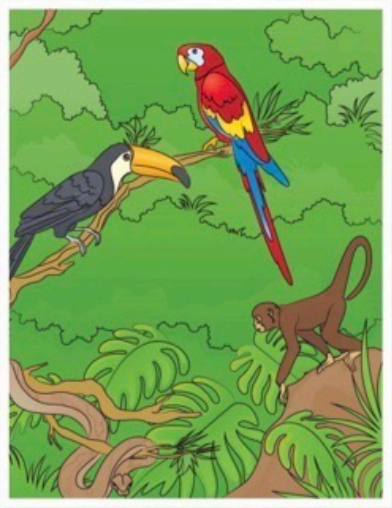
Let's Show It!

1 Read and complete.

destruction ~~Endemic~~ logging habitat erosion endangered sprawl wildfires
dams fragmentation floods degradation invasive trawling landslides

1 Endemic species are living things that can only be found in a geographical region of the planet and nowhere else. If their population in the wild declines, they become 2 ________ species. The major threat to their survival is 3 ________ loss, which can be divided into: habitat 4 ________, 5 ________, or 6 ________. These are caused by human activities such as cutting trees (or 7 ________), introducing 8 ________ species (or species that are not native), building 9 ________, deep fishing (or 10 ________), and urban development (or 11 ________). The consequences of loss of endemic species can be catastrophic. For example, losing plant species that provide the necessary ground cover can generate soil 12 ________, which in turn can create 13 ________ and 14 ________. And, when swamps and marshes are converted for human land use, this generates 15 ________.

2 The local community plans on building a road through this rainforest. Complete the chart with names of animals that will be threatened by habitat loss.



Habitat Loss		
Habitat Destruction	Habitat Degradation	Habitat Fragmentation
toucans		

3 Discuss with a partner why the types of habitat loss in activity 2 will threaten the species.

Habitat … will threaten the … because …

4 Read and complete.

The local community plans on clearing a large area of the tropical rainforest for agriculture. An 1 endemic species of orangutans will be threatened. If the trend continues, the 2 ________ of orangutans in the region will 3 ________ significantly and make them an 4 ________ species.

Project

What Native Species in My Country Are Endangered?

In this project, you will discover if there are endangered native species in your country.

Stage 3: Share your project

If the population of this species continues to decline and they disappear completely, the ecosystem will ...

1 **Use the chart from stage 1. In the same group, create a poster.**

- **a** Organize the information on your poster and include a picture of the endangered species.
- **b** Write the facts you gathered from research about the endangered species.

2 **Present your project to the rest of the class.**

- **a** What has contributed to the decline in the population of this endangered species?
- **b** What will happen to the ecosystem if this endangered species disappears altogether from the planet?

Stage 4: Evaluate your project

1 **Ask your classmates to evaluate your presentation.**

- **a** Is the information clear?
- **b** Do you make eye contact with your audience when you speak?
- **c** Do you give your audience time to ask questions at the end of your presentation?
- **d** Are there any spelling or punctuation mistakes on your poster?

2 **What did you learn from your research and presentation? What would you do differently?**

UNIT 1

Unit Review

1 Go back and watch the video ▶

2 Now complete the activities on your **Video Worksheet**

UNIT 2

Why Are Ecosystems So Important?

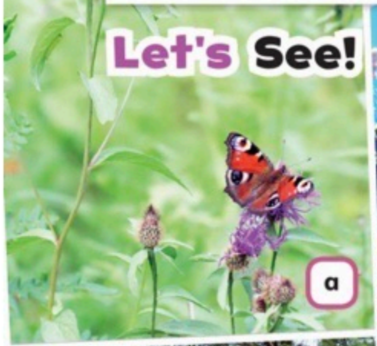
Watch the video

Lesson 1: What do ecosystems do for all of us?

Learning Goals In this lesson, you will compare the basic characteristics of ecosystems and describe the services that they provide.

Inquiry Skills You will also classify elements from ecosystem services.

Let's See!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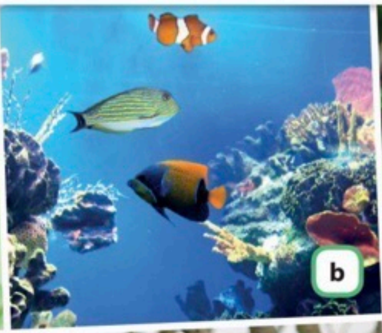
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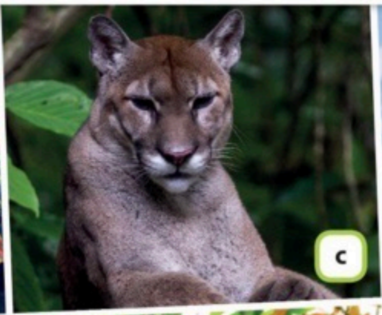
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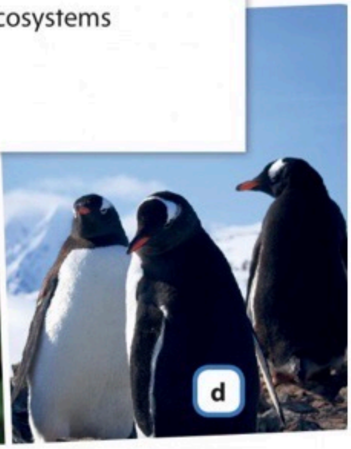
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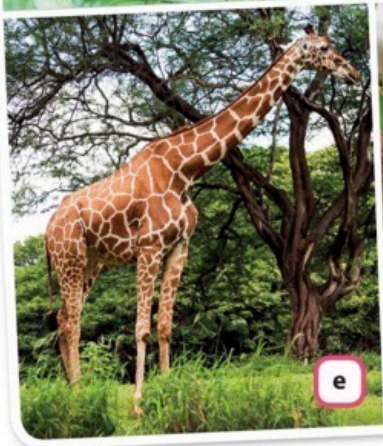
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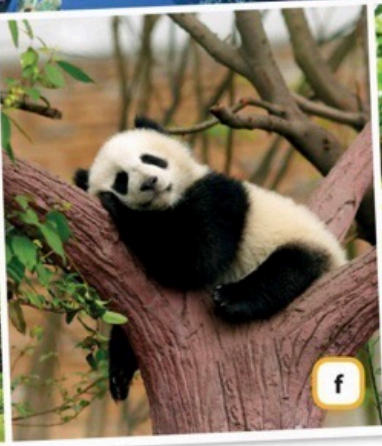
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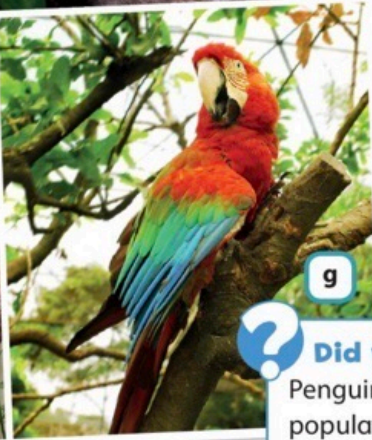
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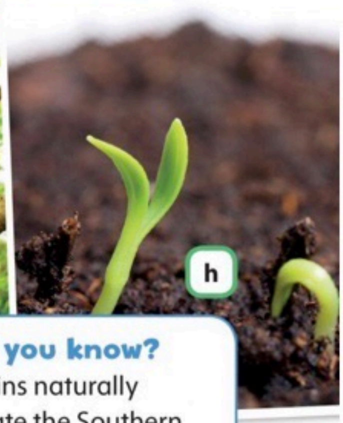

h

Did you know?
Penguins naturally populate the Southern Hemisphere of the planet and not the North Pole.

① Classify the biotic and abiotic factors in the pictures.

Ecosystem Components		
Biotic Factors		Abiotic Factors
macaw		soil

② **How do abiotic factors benefit living things? Discuss with a partner.**

Soil provides ... to ... because ...

Let's Try!

Where Do Things We Use Come From?

1 Draw the materials classification chart on the paper.

2 Walk around your school and write as many things as you notice that you use almost every day.

3 In pairs, compare your lists and write where you think each thing comes from.

4 Do you think ecosystems have enough resources to satisfy humans' needs? Why? Discuss with your partner.

I think ecosystems have / don't have enough resources because ...

Materials

- One sheet of paper
- Colored markers

Classification Chart

Materials	Origin
paper	trees

Let's Learn!

① **How are ecosystems grouped? Read and answer.**

Biomes and Ecosystems

The Earth is a complex system of living things constantly interacting with their environment. The interactions among micro-organisms, plants, and animals with the abiotic factors of an area make up an ecosystem. Ecosystems can be as small as a puddle or as large as a whole forest. However, there are ecosystems that share characteristics. Scientists have grouped those together and called them biomes. Biomes are large geographical areas where plants and animals have successfully adapted to the climate of that region of the world. For example, camels have successfully adapted to the harsh conditions of deserts and go without water for many days.

② **Read again and complete the sentence.**

______ determines the types of plants and animals that live in a biome.

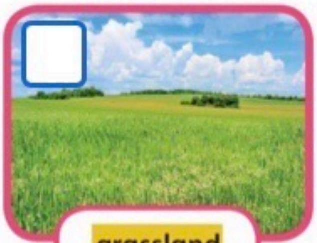
③ **Why do camels naturally live in deserts and not in the North Pole? Discuss with a partner.**

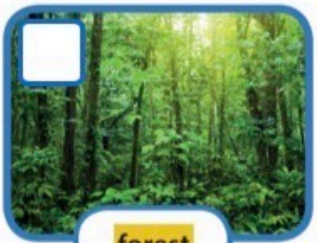
Camels are not naturally found in the North Pole because they ...

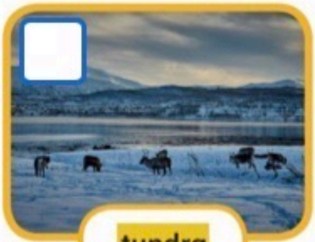
4 How many biomes are there in the world? Listen and answer. 12

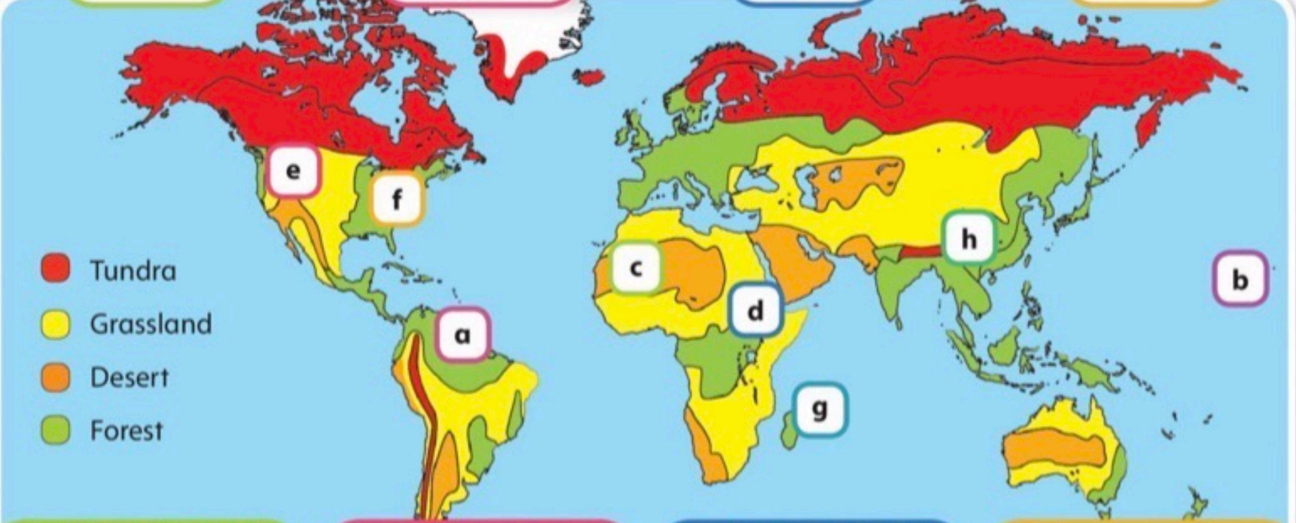
5 Listen again and match the pictures to the biomes. 12

☐ marine


☐ grassland

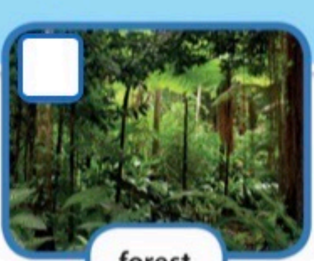

☐ forest

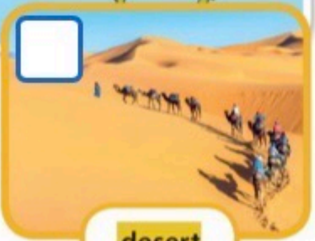

☐ tundra



a freshwater

☐ grassland


☐ forest

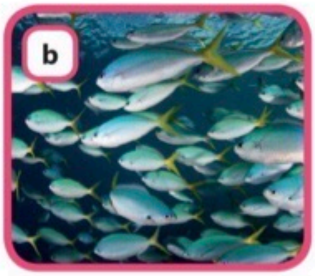

☐ desert

6 Complete the chart with words from activity 5.

Biomes		Subdivision
Aquatic		ponds and lakes, streams and rivers, and wetlands
		oceans, coral reefs, and estuaries
Terrestrial		hot and dry, semi-arid, coastal, and cold
		tropical, temperate, and boreal
	grassland	savannah, temperate, and steppes
		Arctic and alpine

⑦ **Where do materials to make products come from? Match the ecosystems to the products. Then read and check.**

a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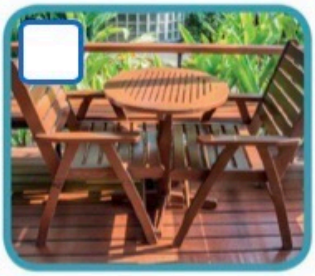

☐

☐

☐

b

Ecosystem Services

The Earth's ecosystems provide goods and services to all living things, including human beings. The benefits that ecosystems provide to support the quality of our life are divided into categories called provisioning services, regulating services, and supporting services. Provisioning services are the raw materials obtained from ecosystems, such as wood for paper or furniture, plants for medicines, flowers for tea, freshwater to drink, and plants and animals for food, fuel, or fiber. Regulating services are the benefits received from activities within ecosystems that regulate processes in nature like the quality of air, the climate, water purification, or soil erosion prevention. An example of a regulating service is the flood prevention that wetlands provide. Supporting services are those that are fundamental for the other services and include plant photosynthesis, spreading seeds by insects and animals, or pollination, and water cycling, among others.

⑧ **Read again and complete the chart.**

Ecosystem Services		
Provisioning	**Regulating**	**Supporting**
paper, furniture, food, medicines, tea, fiber, fuel, freshwater		

9 **What cultural services do ecosystems provide? Read and match the pictures**

Ecosystem Cultural Services

Cultural services are the benefits that human beings receive from ecosystems. These benefits are not associated with materials, but are an important aspect of people's lives.

a Through history, many societies have had a spiritual or religious connection with the natural environment. Ecosystems in their regions have elements that are essential for their beliefs. For example, the traditional Eskimo culture believes that animals and people have souls, and the Maasai in Kenya and Tanzania are known to maintain a harmonious relationship with wild animals as part of their connection to their environment.

b Ecosystems also support the recreational needs of people. Most of us enjoy spending our leisure time vacationing in environments that are rich in biodiversity. The time spent outdoors brings back a sense of tranquility and fun to most people.

c Furthermore, ecosystems provide an aesthetic value to our lives. Through the stimulation of our senses with vivid colors or pleasant sounds, we tend to find beauty in nature. As a result, we are inspired by the natural environment to create poetry, make music, and imitate nature through art.

c

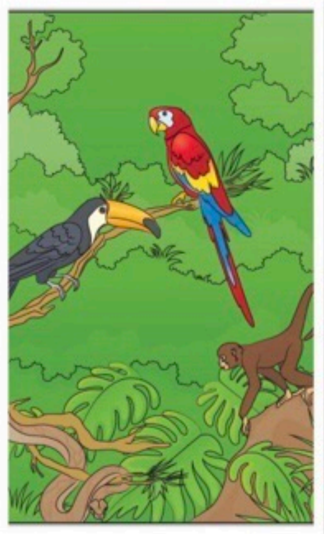
10 **Read again and classify.**

Ecosystem Services		
Spiritual	**Recreational**	**Aesthetic**
☐	outdoor activities	☐
☐	☐	☐

Let's Do It!

1 **Read and complete the article with words from the box.**

climate library ~~wait~~ island species



Dear Dr. D'Phardest,

I couldn't ^{1} wait to tell you that you're absolutely right: all ecosystems have characteristics that they share regardless of where on Earth we are. All have abiotic and biotic factors that are defined by the ^{2} ______ and geography of the region. And, all ecosystems provide services. I'm ready to go back to school to show you the sample pictures I've taken of the endemic ^{3} ______. I know that we have to classify them to study them. But, since there's no Internet access on this part of the ^{4} ______, do you think you could send me some classification charts from the ^{5} ______ or bring them with you on your next trip?

Thanks, professor!

Adelina Walls

2 **Find clues in the postcard picture and classify the ecosystem services that Adelina refers to in her note to her teacher.**

Ecosystem Services: Tropical Rainforest			
Provisioning	**Regulating**	**Supporting**	**Cultural**
wood for furniture			

3 **What similar services can other ecosystems in different biomes provide? Complete the chart. Then discuss in small groups.**

Ecosystem Services	Grassland: Savanna	Forest: Boreal
Provisioning		
Regulating		
Supporting	photosynthesis	
Cultural		

The savanna can provide ... for ... because ...
That's similar to what the ... can provide because ...

Let's Show It!

1 Read and complete.

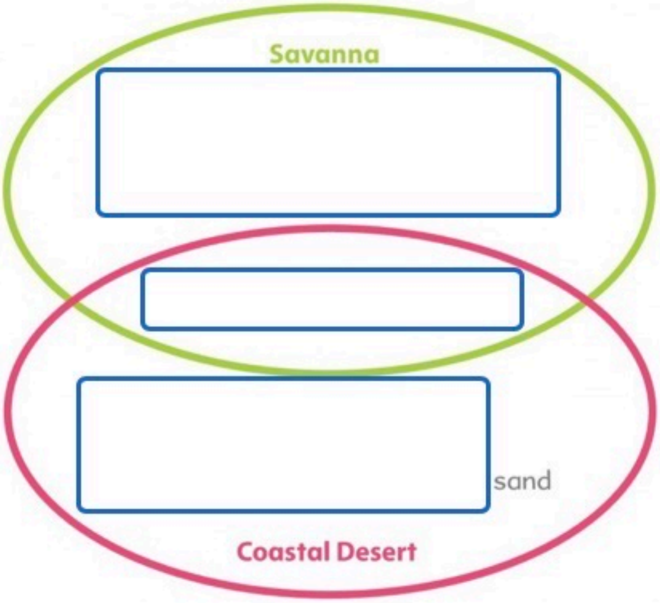
marine ~~biome~~ deserts climate terrestrial freshwater forest grasslands tundra

A 1 biome is a large geographical area with a group of ecosystems with similar characteristics defined by the 2 ____ of the region. There are six main biomes, classified into two major groups: aquatic and 3 ____. Aquatic biomes can be 4 ____ or 5 ____. Terrestrial biomes include 6 ____, which have species successfully adapted to the hot temperatures and low amount of rainfall. There are also the 7 ____, subdivided into the savanna, temperate, and steppes. The 8 ____ presents very low temperatures. And, finally, the 9 ____ biomes are subdivided into tropical, temperate, and boreal.

2 Do research and compare the two ecosystems. Then complete the Venn diagram.

savanna

coastal desert



3 Classify the ecosystem services that the savannah provides.

Ecosystem Services			
Provisioning	Regulating	Supporting	Cultural
	flood control		

Project

How Do Ecosystems Benefit My Community?

In this project, you will describe ecosystems in or around your community and identify the services that they provide.

Stage 1: Plan your project

1. In small groups, assign the categories each member will research: biome, type of ecosystem, endemic animals and plants, climate, and types of ecosystem services.
2. Make a chart to organize your data.

Name: Dora G. Towers		Climate:	
Biome	Ecosystem	Endemic Animals	Endemic Plants
Desert	Semi-arid desert		Old man cactus
Ecosystem Services			
Provisioning	Regulating	Supporting	Cultural
Fruit from cacti			Botanical gardens for education

Stage 2: Develop your project

1. Do your research in the library or on the Internet.
2. Collect five images, including maps, to illustrate and support your research.
3. Write in the chart the information you gathered from research.

UNIT 2

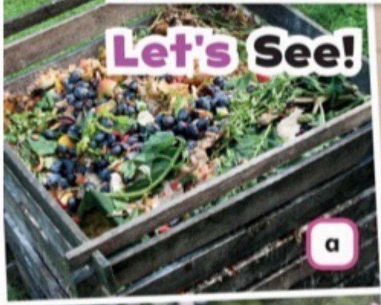
Why Are Ecosystems So Important?

Lesson 2: What can we do to care for ecosystems?

Learning Goals In this lesson, you will identify actions to implement that can prevent ecosystem depletion and biodiversity loss.

Inquiry Skills You will also make inferences based on facts.

Let's See!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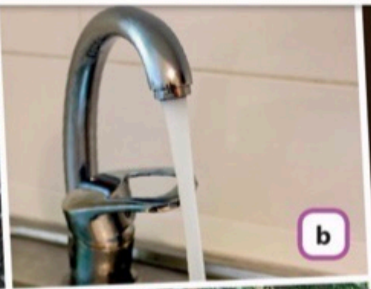
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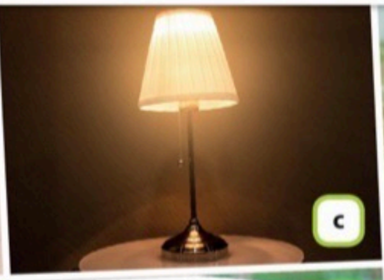
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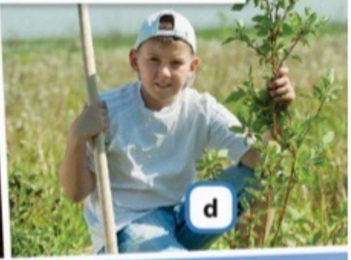
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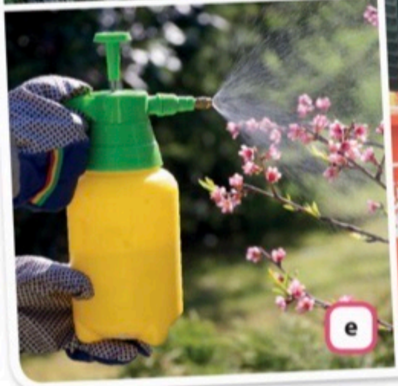
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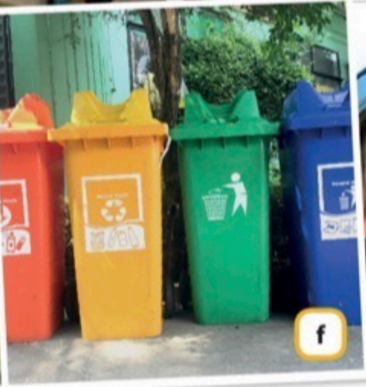
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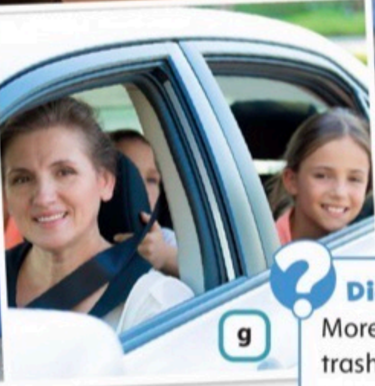
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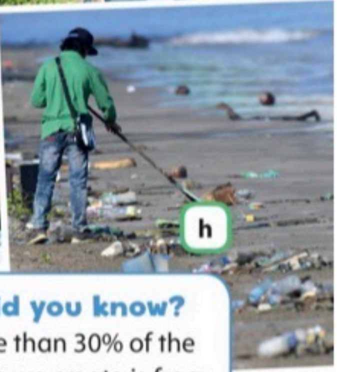
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Did you know?
More than 30% of the trash we create is from packaging materials.

① What effects do activities have on ecosystems? Match the pictures to the activities.

Positive Effect	Negative Effect
☐ organic waste compost	☐ using chemical pesticides
☐ sorting and recycling	☐ garbage on the beach
☐ planting trees	☐ leaving lights on
g carpooling	☐ leaving water running

② What other activities can have a negative impact on ecosystems? Discuss with a partner.

... can have a negative impact on ecosystems because ...

Let's Try!

What Can Empty Water Bottles Be Used for?

1 Cut off the top of the plastic bottle to make a pencil holder.

2 Apply several coats of paint.

3 Once the paint is dry, decorate the bottle with stickers.

4 What else can you do to reuse plastic bottles? How can reusing plastic bottles help prevent biodiversity loss? Discuss with a partner.

Materials

- One plastic bottle
- Scissors
- Acrylic paint
- One paintbrush
- Stickers

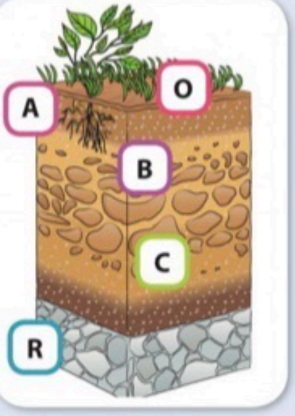
I can reuse plastic bottles for ... This can help prevent biodiversity loss because ...

Let's Learn!

① **What layer of soil has the nutrients for plant growth? Read and answer.**

Soil

Soil is the fragile cover of Earth, and it has minerals, organic matter, water, and air. It provides the medium for plant growth. Soil is divided into layers called horizons: organic (O), topsoil (A), subsoil (B), parent material (C), and bedrock (R). The organic and topsoil horizons are the most productive layers for plant growth and agriculture. In fact, topsoil is so important and delicate that it takes nature about 500 years to build 2.5 centimeters of it. Topsoil is formed from rocks and decaying plants and animals. Bacteria and fungi help decompose the organic matter in soil, and the roots of plants make soil loose and allow oxygen to penetrate. Plant roots also help keep soil together to prevent erosion.



② **Read again and match the letters to the names of the soil horizons.**

Soil Horizons				
☐ organic	☐ topsoil	B subsoil	☐ parent material	☐ bedrock

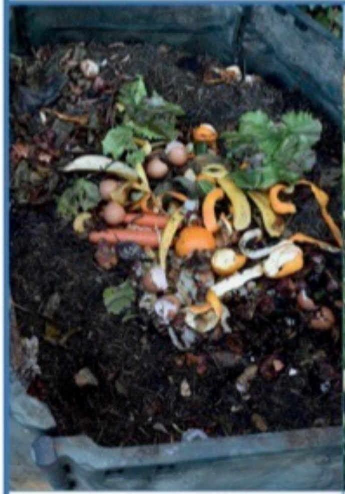
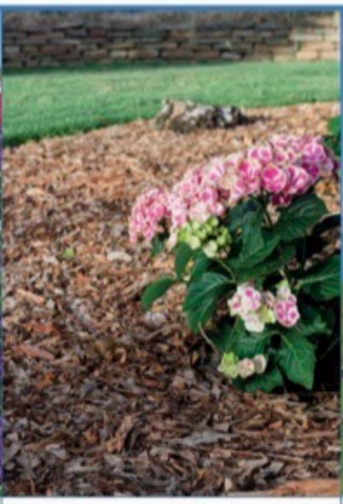
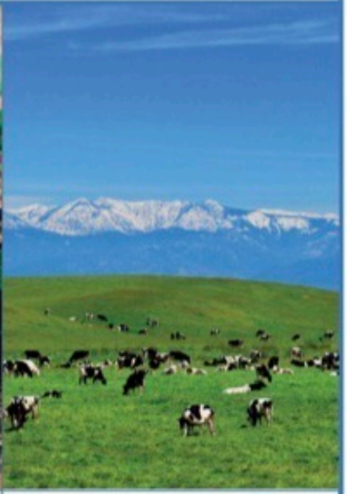
3 **Why is topsoil important for agriculture? Discuss with your partner. Then read and check.**

Topsoil is important for agriculture because ...

Sustainable Agriculture

Traditionally, agriculture has been associated with biodiversity loss because of logging, the use of chemical pesticides and fertilizers that pollute the soil, water, and air in the area, and the introduction of invasive species, such as cattle and crops (cultivated plants). These practices and the worldwide increase of human population have created serious depletion of ecosystems, or overexploitation. The resulting biodiversity loss and scarcity problems have forced people around the world to think of alternatives that are environmentally safe. Sustainable agriculture promotes raising livestock (animals) and growing crops in a way that minimizes the negative impact on an ecosystem. In sustainable agriculture, topsoil must be protected and nurtured to prevent erosion. Therefore, tillage, or the tearing of the soil structure to make it loose, is highly discouraged. Also, the use of chemical fertilizers must be replaced with compost (organic waste) and manure (animal waste). Moreover, the soil must remain covered with plants or mulch, such as leaves and straw, to keep it moist. Finally, carefully monitored livestock grazing is important so that the soil is constantly replenished after animals have been fed for a while in the same pasture. It's also important to select crop species that can easily adapt to the soil and climate conditions of the area. Crop rotation, or cultivating different crops instead of always the same type, can help keep the topsoil nutrient-rich.

4 **Read again and complete the table.**

Sustainable Agriculture Alternatives			
			
	crop species selection		

5 What can help protect the environment in urban areas? Look at the pictures and discuss in small groups.

... can help protect the environment because ...

a

b

c

d

6 Read and complete. Then listen and check. 13

recycled ~~houses~~ natural vehicles urban waste

Sustainable Communities and Smart Growth

Sustainable communities are places where people are aware of the need to protect ecosystems. In these communities, instead of building new [1] houses, old ones are restored to reduce urban sprawl. To reduce air pollution, people walk or ride a bike, and hardly ever use motor [2] ______. Parks and green areas are protected, and trees are planted to create new habitats. 3Rs (reduce, reuse, recycle) programs are followed and respected by everyone to decrease the amount of [3] ______. For example, people buy less packaged products to reduce the amount of garbage, reuse empty bottles and containers, or have them [4] ______. In contrast, smart growth is a planning method to avoid [5] ______ sprawl. This method promotes the careful development of compact urban areas where people don't have to travel long distances and [6] ______ resources are used responsibly to minimize pollution and waste.

7 Listen again and match the pictures in activity 5 to the statements. 13

Environmentally Responsible Urban Life	
Smart Growth	**Sustainable Communities**
☐ Reduce air pollution and protect green areas.	☐ Support local farmers and reduce the amount of waste.
d Restore old houses.	☐ Follow the 3Rs program.

8 Read and complete.

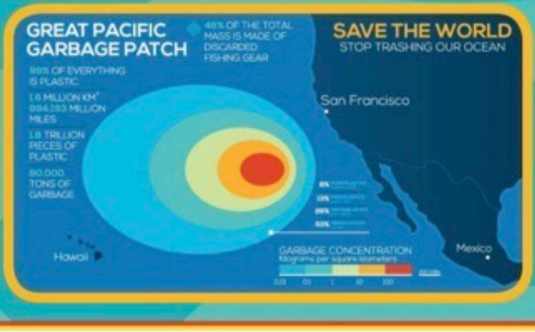
Smart growth and sustainable [1] communities help protect ecosystems because they advocate not building new homes, discouraging urban [2] ______. This can [3] ______ habitat loss and helps [4] ______ biodiversity in the area.

9 **What happens when garbage is not placed in a trashcan? Order the pictures 1–3 according to what happens first. Then read and check.**

The Great Pacific Garbage Patch

1

☐


GREAT PACIFIC GARBAGE PATCH
48% OF THE TOTAL MASS IS MADE OF DISCARDED FISHING GEAR
99% OF EVERYTHING IS PLASTIC
1.6 MILLION KM² 994,193 MILLION MILES
1.8 TRILLION PIECES OF PLASTIC
80.000 TONS OF GARBAGE
SAVE THE WORLD
STOP TRASHING OUR OCEAN
San Francisco
Hawaii
Mexico
GARBAGE CONCENTRATION
Kilograms per square kilometers

☐

Throughout the world, on average, one person generates 1.8 kilograms of garbage per day. This waste not only pollutes nutrient-rich topsoil, but also our oceans. As a matter of fact, a lot of plastics and other trash get washed away by rainfall and end up floating on seawater. There, the trash gets trapped in circular ocean currents, called gyres, and swirls around until it forms a floating island of garbage. The Great Pacific Garbage Patch is an example. Here, garbage from North America and Asia has been trapped in gyres and formed a gigantic patch located between Hawaii and California. The consequences to marine ecosystems are devastating. For example, plastics are frequently eaten by marine wildlife or end up trapping species until they die. Those garbage patches also block sunlight and prevent it from reaching marine plant species, like algae and plankton, which require the light for photosynthesis. These plant species are the foundation for marine food webs. Many marine species that feed on them are themselves the food for larger predators, such as sharks and whales.

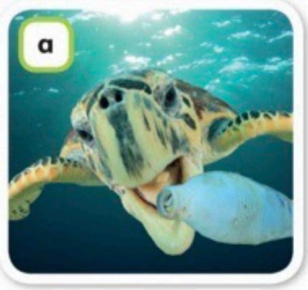
10 **Read again and complete the sentences.**

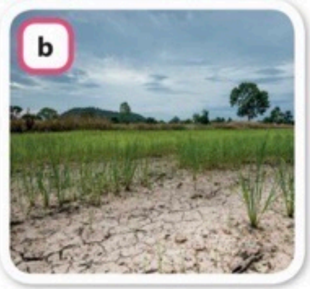
Plastics and trash floating on seawater are trapped in ¹ gyres and form a large patch of ² ________ that blocks ³ ________ and prevents it from reaching marine plant species that need it for photosynthesis to grow and reproduce. If the population of marine plant species decreases, the population of species that feed on them will ⁴ ________. This results in significant ⁵ ________ loss.

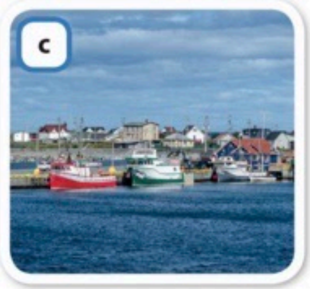
Let's Do It!

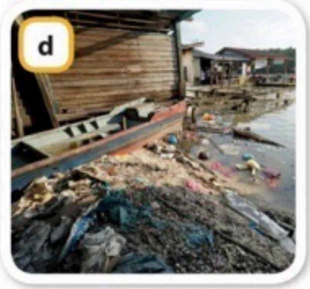
1 **Oscar is developing a plan to prevent ecosystem depletion and biodiversity loss in his community. What is causing damage to the environment? Circle the clues you find in the pictures. Then discuss in small groups.**

In picture ... is/isn't causing damage to the environment because ...









2 **What is going to be done to prevent environmental problems in Oscar's community? Complete the chart with prevention methods.**

Facts	Prevention Method
Animals are eating garbage.	A 3Rs program is going to be implemented to reduce, reuse, and recycle waste.
Agricultural activities are creating soil erosion.	
Housing development is causing habitat loss.	
Marine life is affected by water pollution.	

3 **Read and complete.**

Oscar's community benefits from the ^{1} provisioning services that their ecosystem provides. His community is a fishing community, but birds and marine animals are eating plastics and dying. As a consequence, the population of fish in the ecosystem is likely to ^{2} ________. If prevention methods are not implemented, this will affect the community because ^{3} ________ food will be available to them.

Let's Show It!

1 Read and complete.

compost mulch ~~soil~~ topsoil grazing manure crops livestock gyres horizons 3Rs

1 Soil is the cover that sustains most of life on Earth. It's divided into layers, or 2 ______. Plant ground cover grows on 3 ______. For sustainable agriculture, this layer must be protected and nurtured. This is done by avoiding the use of chemical fertilizers. Instead, 4 ______ and 5 ______ are used to keep the soil nutrient-rich. Soil is covered with plants or with 6 ______ to keep it moist. And, 7 ______ are rotated so that the nutrients in soil are not depleted. Another way farmers protect soil is by making sure that 8 ______ on a pasture for 9 ______ don't leave the soil depleted of plant ground cover to avoid erosion. Other effective techniques to protect soil and biodiversity are the management of waste and urban sprawl. Sustainable communities use the 10 ______ program to reduce, reuse, and recycle garbage, while local governments use the smart growth planning method to prevent urban sprawl. It's important to reduce waste because it's been discovered that garbage gets trapped on ocean currents called 11 ______. This creates what seems like gigantic floating islands of trash that destroy marine wildlife.

2 Complete the chart with prevention methods.

Ecosystem Depletion and Biodiversity Loss Prevention Methods			
3Rs	Sustainable Agriculture	Smart Growth	Sustainable Communities
______	using compost or manure	______	______

3 What happens to topsoil when livestock is allowed to overgraze the land? Read and complete.

Overgrazing leaves soil without the necessary plant cover to maintain 1 biodiversity. This also causes ecosystem 2 ______ because the soil loses its ability to regulate its processes, such as water availability.

Project

How Do Ecosystems Benefit My Community?

In this project, you will describe ecosystems in or around your community and identify the services that they provide.

Stage 3: Share your project

① Create a poster with the information from your research and the chart from stage 1. Include the following information:
  - **a** Is the ecosystem depleted?
  - **b** Is there biodiversity loss?
  - **c** What prevention methods and activities can be implemented to prevent ecosystem depletion and biodiversity loss?

② Present your project to the rest of the class.
  - **a** Explain the ecosystem's current problems and proposed prevention methods.

Stage 4: Evaluate your project

① Ask a classmate to evaluate your presentation.
  - **a** Is the information clear?
  - **b** Are there at least five visual elements to illustrate your poster?

② What did you learn from your presentation? What would you do differently?

UNIT 2

Unit Review

① Go back and watch the video ▶

② Now complete the activities on your **Video Worksheet**

What Have You Learned?

1. Go back to page 35. Write more words for each picture. Which picture has the most words?

2. Discuss these questions.

   What will happen if we don't protect our ecosystems?

   Why are ecosystems so important?

Do You Want to Know More?

You can learn more about biodiversity and the classification of living things, watch videos, or build a tree house at this site:
http://tolweb.org/tree/learn/kids.html

Play games, solve puzzles and mazes, color pages, or find fun facts on endangered species at this site:
http://www.animalfactguide.com/fun-stuff/

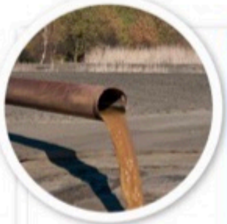
Play games while you learn more about biomes at this site:
http://kids.nceas.ucsb.edu/biomes/

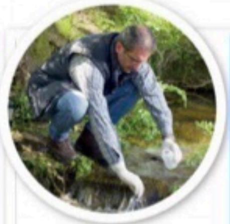
Learn more about 3Rs programs and the Great Pacific Garbage Patch, send ePostcards, and play games at this site:
http://greenplanet4kids.com/

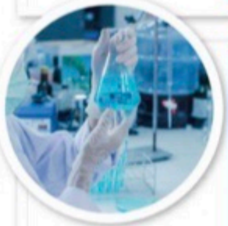
BLOCK 3

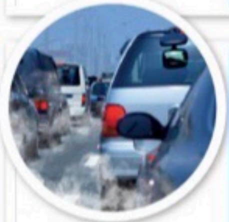
Matter and Materials

Find the words for each picture.









residual water treatment plant
clarification tanks
phosphates
petroleum distillates
solute
solution
solvent
effluent
chlorine
activated sludge
geothermal power
water loss
grit tanks
scum
biomass power
carbon monoxide (CO)
pure substances
bar screens
perspiration
wastewater
solubility
freshwater
homogeneous
component
diarrhea
dehydration
distillation
stabilization pond
concentration
evaporation
total suspended solids (TSS)
colloid
breath
filtration
volatile organic compounds (VOCs)
wind power
heterogeneous
atmosphere
suspension
ozone (O_3)
solar power
particulate matter (PM)
influent
sedimentation tanks
septic tank
sludge
fossil fuels
turbidity
troposphere
emissions
mixtures
solar power
sulfur dioxide (SO_2)
nitrogen dioxide (NO_2)
stratosphere
sieving
physical changes

UNIT 1

Why Is Water Important for Our Planet?

Watch the video

Lesson 1: How does water function as a solvent?

Learning Goals In this lesson, you will identify water as an important component of living organisms and as a natural solvent of many substances.

Inquiry Skills You will also identify solutes and solvents in liquid solutions.

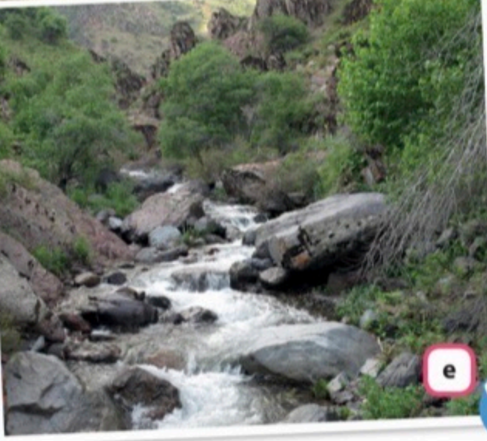
Let's See!

a

b

c

d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Did you know?
The average human brain is about 78% water.

① What are the different states of water? Complete the table.

Solid	Liquid	Gas
snow		

② When do you use water in your daily life? Discuss with a partner.

I use water to ... when ...

Let's Try!

Why Is Most of Earth's Water Undrinkable?

1 In pairs, pour the water into one cup and the oil into the other cup.

2 Put one teaspoon of salt in each cup.

3 Stir one cup for 40 seconds using the spoon while your partner does the same with the other cup.

4 Observe the cups against a source of light.

5 Can you see the grains of salt? Discuss with your partner.

I can/can't see the grains of salt in the cup of … because …

Materials

- Two transparent plastic cups (220 ml)

- One-quarter cup of water

- One-quarter cup of cooking oil

- Two teaspoons of salt
- Two plastic spoons

Let's Learn!

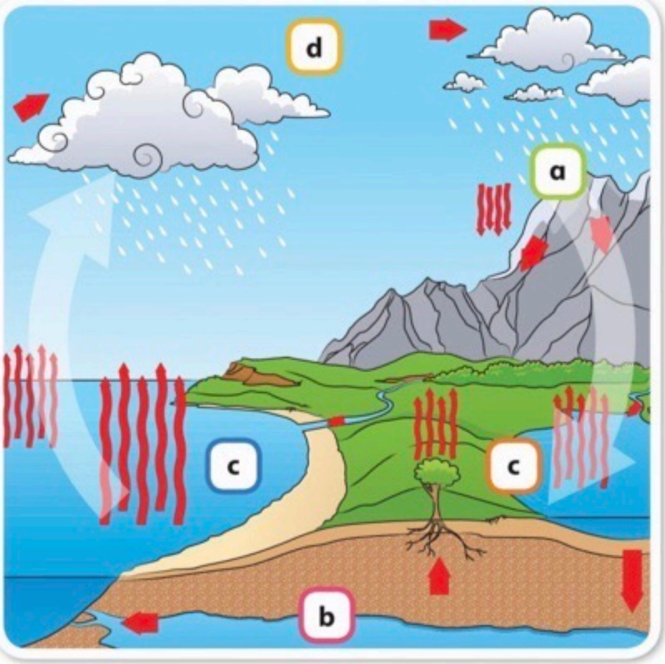
① **Where can we find most of Earth's freshwater? Read and complete. Then listen and check.** 14

~~alive~~ fresh solid salty

The Water Cycle

Water is the essential substance of life. All living things require water to stay ¹ alive . Water is the substance that can be found in nature in its three states: liquid, ² ______, and gas. These states are in constant flow to create a cycle. Most of Earth's water can be found in oceans. In fact, 96.5% of the water on our planet is found there. Unfortunately, it's so ³ ______ that it makes it undrinkable for a lot of species. Most species need freshwater to survive and only 2.5% of Earth's water is ² ______.

② **Listen again and complete.** 14



a Ice and snow 2.38 %

b Groundwater ______ %

c Surface water ______ %

d Atmosphere ______ %

3 **How much water does a person need every day to stay alive? Circle the answer that you think is correct. Then read and check.**

- a about 20 l/day
- b about 2 l/day
- c about 3 l/day
- d about 666 l/day

Water and Living Things

The amount of water we consume depends on its availability. For example, the average water consumption for the typical African family is 20 liters per day (20 l/day). By contrast, a person from the United States uses about 666 liters of water per day. But, in its most basic use, water supports all of life. In fact, water is so important that living things are mostly made out of it. Most plants are 90% water. And the human body is about 60% water. But, we lose water in many ways. One way is in the form of vapor through our breath.

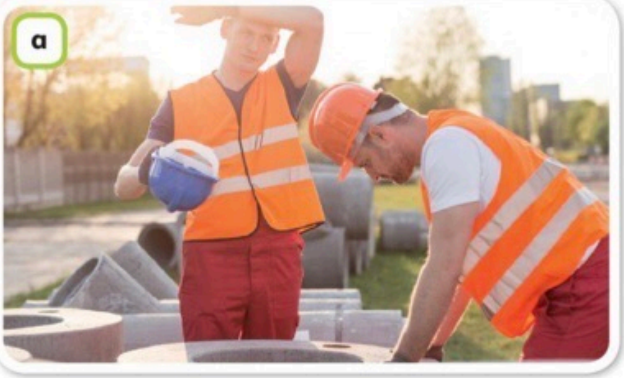
We also lose water by perspiration (sweat), in urine, and in feces. Water loss can also happen when we're sick, through diarrhea and vomiting which can lead to dehydration. This is a dangerous condition that happens when more water is leaving the body than the amount that is entering.

Just to survive, the average person needs about three liters of water per day to replace the water lost. The actual amount depends on different factors such as age, lifestyle, activity level, and temperature of the environment.

4 **Who do you think needs to drink more water to replace the amount lost? Read again and compare the pictures. Then discuss in small groups.**

The person in picture ... needs to drink more water than the person in picture ... because ...

a



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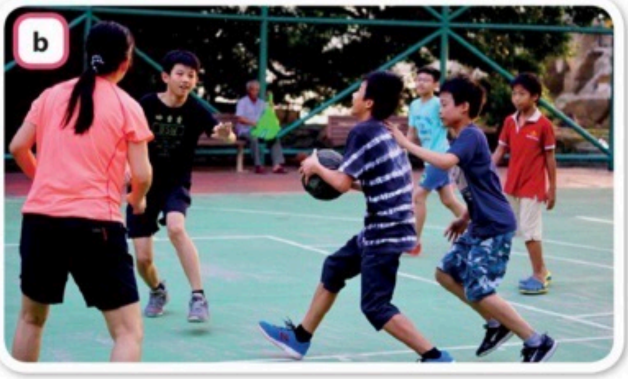

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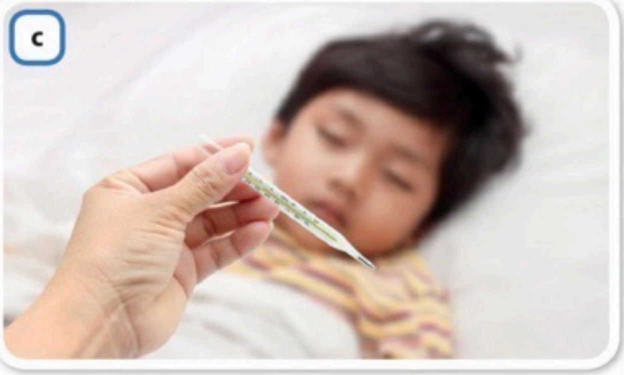

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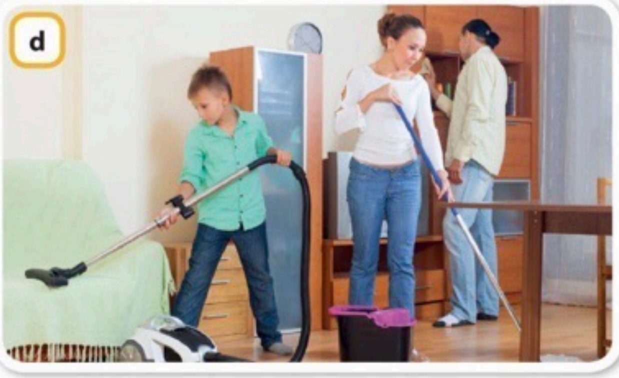


5 **What characteristics do these liquids have in common? Compare the pictures and discuss with your partner. Then read and check.**

All of them ... because ...

Water As a Universal Solvent

Seawater, the water of the oceans, is the most abundant liquid on Earth. It is also a **solution**. A solution is a **homogeneous** or uniform, combination of two or more substances. Seawater is a liquid solution made up by a mixture of about 96.5% water and 3.5% salts. It's homogeneous because you can't see the salt grains apart from the water. When salt dissolves in water, the salt becomes a **solute**. Solutes are substances that dissolve in another substance. And, when water is the substance that does the dissolving, it is called a **solvent**. Solvents are the substances that do the dissolving. Water is called the universal solvent because it can dissolve more substances than any other liquid.

6 **Read again and match the pictures in activity 5 to the correct solution. Then complete the sentences.**

☐ A solution with approximately 93.5% water, 6% sugar, and 0.5% minerals. The solutes are [1] sugar and minerals and the solvent is [2] ______.

☐ A solution with approximately 98.75% water and 1.25% plant matter. The solute is [3] ______ and the solvent is [4] ______.

a A solution with approximately 96.5% water and 3.5% salts. The solutes are [5] ______ and the solvent is [6] ______.

7 **Calculate the percentage of solvent there is in the following soft drink. Then explain to your partner how to calculate the amount.**

Cola Soft Drink		
Water	Sugar	Caffeine
	12.5%	0.3%

You can calculate the percentage of ... by subtracting ... from ...

8 How can you know if water is polluted? Look at the pictures and discuss in small groups. Then read and compare your answers.

The water in picture ...
is/is not polluted because ...

Concentration and Solubility

Scientists say that seawater has a salt concentration of about 35,000 parts per million (ppm). Concentration is a measure of the amount of solute in a solution expressed in parts per million (ppm) and is calculated using the mass of the substances. In the case of seawater, the concentration of salts is 35 grams. In other words, one kilogram of seawater (solution) has 965 grams of water (solvent) and 35 grams of salts (solute). This measure is also used to determine how polluted a body of water is. In contrast, solubility is a measure of how much solute will dissolve in a specific amount of solvent at a specific temperature. So, if the temperature changes, so does its solubility. In general, at lower temperatures, solubility decreases. For solids dissolving in a liquid, it can be expressed as grams (g) per 100 milliliters (ml) or g/100 ml. We can use solubility tables to calculate how much of a substance will dissolve in another. Understanding the impact of concentration and solubility in water can help us prevent water pollution.

9 Read again and complete the table with words from the box.

~~Temperature~~ Solvent Solute Solubility

Solubility Table

			Temperature
Aspirin	0.33 g/100 ml	100 ml of water	25°C
Table salt	37.7 g/100 ml	100 ml of water	25°C
Table sugar	211 g/100 ml	100 ml of water	25°C

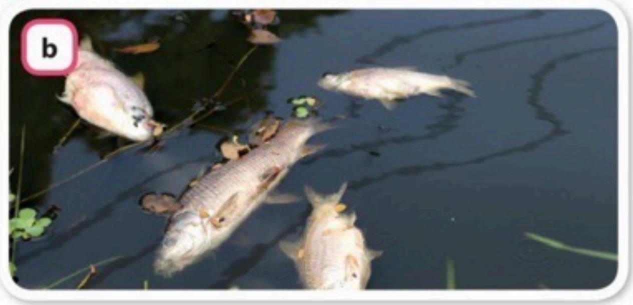
10 Will the solubility of table sugar in 100 ml of water change if we change the temperature to 3°C? Discuss with your partner.

The solubility will/won't
change because ...

Let's Do It!

1 **What are the biologists investigating? Circle the clues you find in the pictures. Then discuss with your partner.**

I found … in picture …
and that may be why …



2 **Listen to biologists Amy and Abdellah talk about Malekov River. Help them complete the chart.** 15

Water Pollutants	
Solute	**Concentration**
Mercury	

3 **Listen again and complete the sentences. Then check your answers to activity 1.** 15

a Amy ____said____ that the concentration of detergent ______ below 15 ppm.

b Abdellah said that there ______ enough detergent in the water to ______ fish, but just about enough to ______ fish eggs.

c Amy said that the concentration of mercury ______ enough to ______ fish.

d Abdellah said that he ______ ______ the fish kill ______ the result of water pollution.

4 **What will happen to the fish population in Malekov River if the concentration of detergent in the water continues to be 12 ppm? Complete the following hypothesis with words from the box.**

~~will~~ detergent population decline

Malekov River [1] ____will____ experience a [2] ______ in its fish [3] ______ if the concentration of [4] ______ in the water is not below 5 ppm.

Let's Show It!

① **Read and complete.**

~~freshwater~~ surface water diarrhea dehydration perspiration water loss breath

The majority of species need [1] freshwater to survive. Most freshwater is found in [2] . In fact, water is so important that living things are mostly made out of it. For example, the human body is about 60% water. But, we lose water in many ways. One way is in the form of vapor through our [3] . We also lose water by [4] (sweat), in urine, and in feces. [5] can also happen when we're sick, through [6] and vomiting which can lead to [7] .

② **Complete the chart.**

Liquid Solutions

Solute 1	Solute 2	Solute 3 ammonia
100 ml of water 4 solvent	130.48 ppm of caffeine 5	35.7 g/100 ml at 20°C 6
8,900 ppm of salts 7	2.17 g/100 ml at 25°C 8 solubility	100 ml of water 9
35.7 g/100 ml at 20°C 10	100 ml of water 11	87.6 ppm of ammonia 12 concentration

③ **What will happen to the saline solution in activity 2 if we dissolve salts until we have a concentration of 35,000 ppm? Write a hypothesis.**

Project

What Effect Does Water Pollution Have on a Community?

In this project, you will discover the effect that polluted water can have on a community.

Stage 1: Plan your project

1. In groups, choose a river in any part of the world. Then choose a specific city or town close to that river.
2. Research the following:
   - a Concentration levels of three water pollutants in the river.
   - b Effect of the three pollutants on aquatic life.
   - c Services that the river provides to the community.

Stage 2: Develop your project

1. Make a chart to organize your data.

River's Name: **Mississippi**		Towns's Name: **St. Louis, Missouri, USA**	
Type of Pollutant	1 Pesticide: dieldrin	2	3
Concentration	0.80 ppm		
Effect on Aquatic Life			
Services provided by the river to the community		a Water supply for daily living b c	

2. Do your research in the library or on the Internet and record your data.
3. Share your data with your group.
4. Analyze your data.

   What effect does water pollution have on health, hunger, or poverty in the region that the river serves?

The concentration of ... affects/doesn't affect ... because ...

UNIT 1

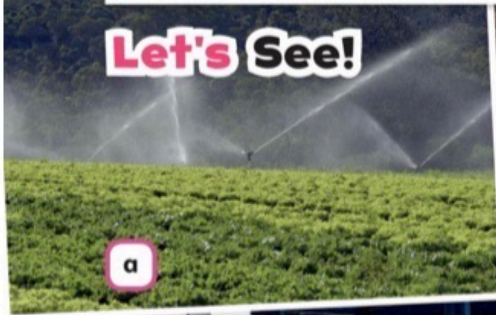
Why Is Water Important for Our Planet?

Lesson 2: How can we prevent water pollution?

Learning Goals In this lesson, you will determine the relationship between solubility and water pollution, and identify measures to prevent water pollution.

Inquiry Skills You will also make inferences based on facts.

Let's See!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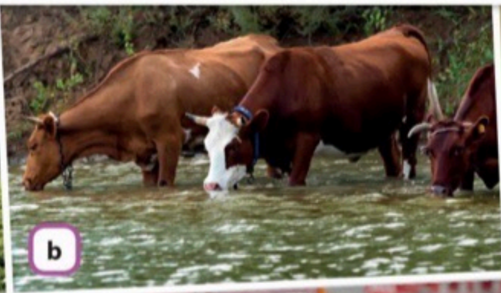
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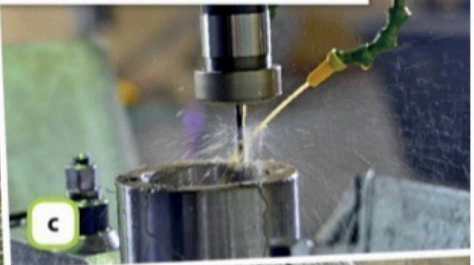
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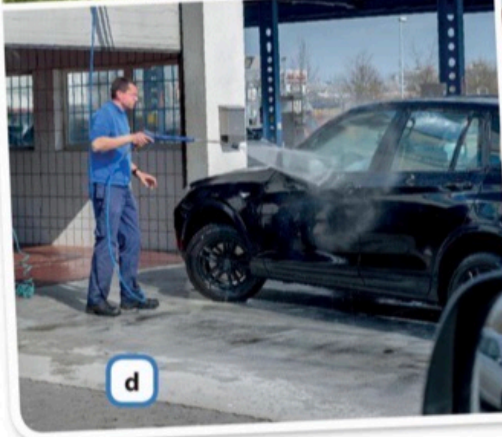
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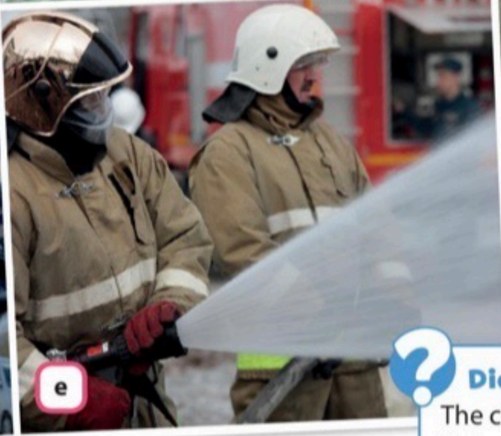
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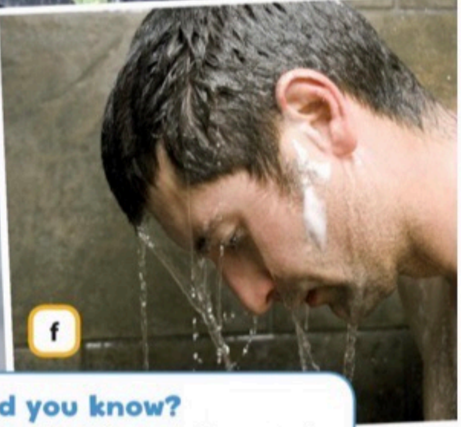
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Did you know?
The chemical formula for water is H_2O: two atoms of hydrogen are bonded to one atom of oxygen.

① **How do we use water? Write the letter next to the water use.**

Homes and Urban	Industrial	Agricultural
f taking a shower	☐ car wash	☐ field irrigation
☐ fire fighting	☐ cooling machines	☐ cattle care

② **What type of use pollutes water more? Compare and discuss in small groups.**

I agree/disagree because ...

I think ... pollutes water more than ... because ...

Let's Try!

Can Water Be Reused?

1 Pour water into the bowl and add vegetable or fruit peels. Use your hand to mash the peels for one minute.

2 Place the sieve on top of the plastic cup and carefully pour the dirty water into it.

3 Look at the water against a light source.

4 Do you see little pieces of peels in the water? Can you reuse this water? Discuss with a partner.

I can/can't see pieces of peels in the water ... I can/ can't reuse this water for ...

Materials

- One plastic bowl
- Water
- Vegetable or fruit peels
- One kitchen sieve
- One transparent plastic cup

Let's Learn!

1 **What happens to water after we use it? Read and answer.**

Wastewater

Water becomes unclean after it has been used. This unclean water is called **wastewater** or residual water, and it's usually contaminated. The solubility of liquid and solid pollutants makes them difficult to detect just by looking at water. But, there are solutes that seriously affect the way water looks and its **turbidity**. Turbidity expresses how much light can pass through water and it depends on the concentration of suspended materials like microbes, soil particles, organic materials, and other substances. **Total suspended solids (TSS)** are all the particles suspended in water that will not pass through a filter and it's expressed in milligrams per liter (mg/l). Suspended solids absorb heat from sunlight and increase water temperature, which decreases the level of dissolved oxygen.

2 **What can happen to cold water fish species if the amount of TSS is high? Read again and complete.**

Suspended solids increase the [1] ___temperature___ of water because they absorb heat from sunlight, which decreases the level of dissolved [2] ________. A high amount of TSS can have a [3] ________ impact on cold water fish species that are sensitive to the level of dissolved oxygen available for their survival.

3 **Match the pictures to the names. Then read and check.**

☐

☐

a

☐

a Stabilization ponds TSS: 30–50 mg/l

b Septic tanks and systems TSS: ______

c Residual water treatment plant TSS: ______

d Rivers, lakes, and the ocean TSS: ______

4 **Read again and complete activity 3.**

The Destination of Wastewater

After we flush the toilet or wash the dishes, the wastewater goes down drain pipes. And, depending on where you live, it may go directly into a river, a lake, the ocean, a septic tank, a stabilization pond, or lagoon, or to a residual water treatment plant. In many rural areas, wastewater goes into septic tanks. There, heavier suspended solids in wastewater, called sludge, settle to the bottom of the tank. Fat, greases, and lighter solids, called scum, float. The water standing in the middle of the sludge and scum has less turbidity and goes through treatment before it is released back into the natural environment. The treated water going out of the tank is called effluent. A typical septic tank's effluent has 45–70 mg/l TSS. In contrast, wastewater from homes that is discharged directly into the natural environment has 700 mg/l TSS on average and the effluent from stabilization ponds can have 30–50 mg/l TSS. Most cities have residual water treatment plants to recycle water. There, the effluent may have less than 25 mg/l TSS.

5 **What can happen to fish habitats when wastewater with 700 mg/l TSS is discharged directly into natural bodies of water? Read and complete.**

Fish habitats can be [1] ______ because suspended solids [2] ______ to the bottom of the river, lake, or ocean.

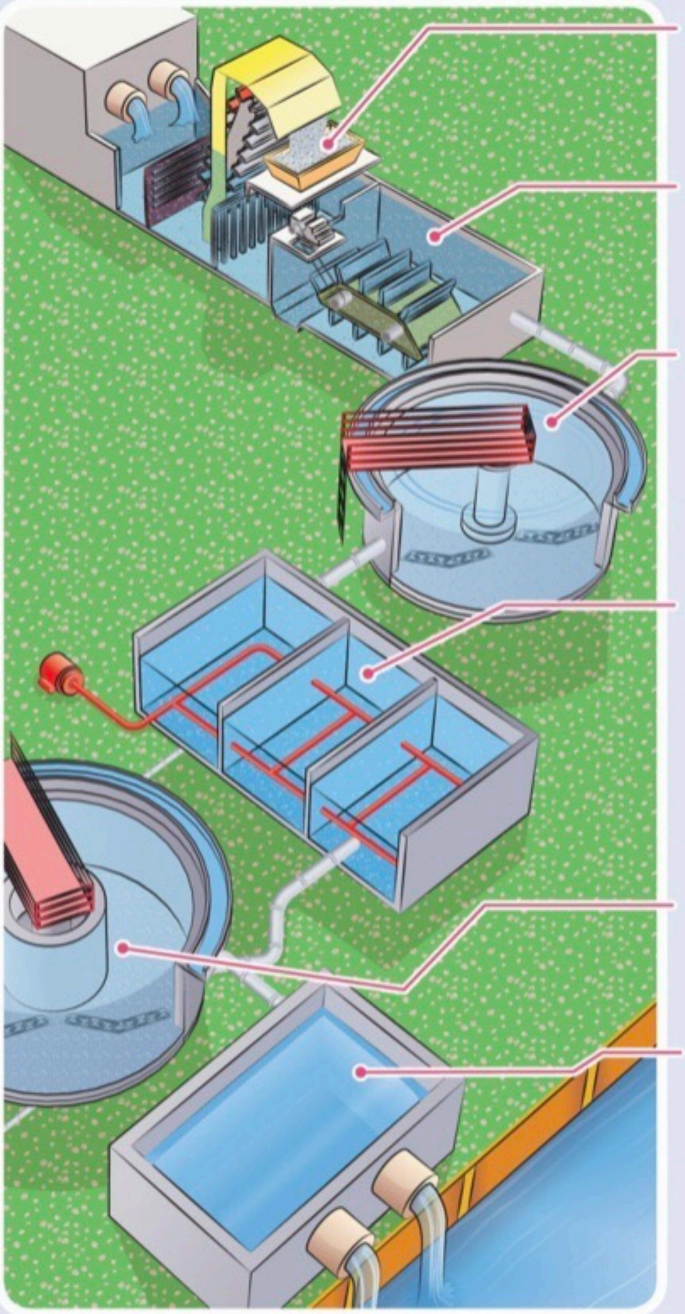
6 **Are TSS and turbidity data enough to decide if effluent is safe for human consumption or for the natural environment? Why or why not? Discuss in small groups.**

TSS and turbidity data are/are not enough to decide if effluent is safe because ...

7 **How is water disinfected in a residual water treatment plant? Explain to your partner. Then listen and check.** 16

Water is disinfected in a residual water treatment plant when …

8 **Listen again and complete the sentences.** 16



Residual water, or influent, flows through bar screens to remove debris and 1 garbage .

Then, wastewater moves through grit tanks to 2 ________ sand and heavy particles that have settled.

Next, water moves to sedimentation tanks and stays there undisturbed for some 3 ________ . Then, 4 ________ and scum are removed.

Later, it moves to aeration tanks. There, 5 ________ called activated sludge decompose the organic matter.

After that, water 6 ________ into clarification tanks.

Next, water is 7 ________ by adding chlorine or with ultraviolet 8 ________ .

Finally, the effluent is 9 ________ into streams, 10 ________ , lakes, or oceans.

9 **What device in the residual treatment plant will most likely catch a necklace if you accidentally throw it down the sink? Explain to your partner.**

The … will catch the necklace because …

10 **How can we prevent water pollution? Match the words to the pictures and explain to your partner. Then read and check.**

We can prevent water pollution with ... if we ...

- **a** pesticides
- **b** cleaners
- **c** paint
- **d** medications

Solutes and Effluent

Effluent with dissolved chemicals can damage the natural environment. Measures to reduce the dangerous impact of those solutes on the environment can start at home. Typical household products may contain a variety of hazardous ingredients such as phosphates, chlorine, ammonia, and petroleum distillates. Phosphates are minerals that can increase algae growth in bodies of water. This decreases the amount of dissolved oxygen in water necessary for healthy aquatic life. Petroleum distillates can be toxic to aquatic life even in low concentrations. The use of natural alternatives and responsible use of household products can prevent water pollution and damage to aquatic life. Plant-based or food-based products, such as baking soda and vinegar, can be used as an alternative to cleaning products. Natural fertilizers for gardens like compost and rotted manure are also environmentally safe alternatives to chemicals. Responsible use means that a product is used only when absolutely necessary and in small amounts. It also refers to the proper disposal of household products like not flushing or pouring down the drain medications, paint, chemicals, personal care products, or grease and oil. Instead, that waste can be placed in a trashcan or taken to a recycling facility.

11 **What can happen to aquatic life when effluent containing phosphates is discharged into a lake? Read and complete.**

Aquatic life in the lake can be damaged because ^{1} phosphates are known to ^{2} ________ algae growth. This ^{3} ________ the amount of dissolved oxygen that is necessary for ^{4} ________ aquatic life. Also, ^{5} ________ growth prevents light from penetrating the water, which ^{6} ________ photosynthesis and food availability for fish and other organisms.

Let's Do It!

1 Russell bought some land 500 meters away from Malekov River. He's going to build a house and also needs to build a sewage system for the residual water. The closest municipal sewage system connection is 700 meters from his land. What do you think he should do? Discuss in small groups.

Russell should … because …

2 In small groups, help Russell complete his cost–benefit analysis chart.

Options	Effluent TSS	Cost	Benefits	Problems
Sewage pipeline to wastewater treatment plant	a	$5,450.00	b	c High levels of chlorine can harm aquatic ecosystems.
Septic tank and system	d	$5,200.00	e	f
Direct release into the natural environment	g	$375.00	h It's very easy to build and the cheapest option.	i

3 What type of sewage system does Russell need to build? Use the information from the cost–benefit analysis chart and discuss in small groups.

Russell needs to … because …

4 Report some ideas your classmates shared.

a One of my classmates told us that Russell needed to build a cheap sewage system. But, we said that protecting the environment was more important.

b

c

Let's Show It!

① **Read and complete.**

septic ~~wastewater~~ turbility effluent sedimentation residual bar screen aeration tank chorine stabilization total suspended solids (TSS)

Water that has already been used in homes, cities, agriculture, and industry is called [1] wastewater or residual water. Most of it tends to have [2] ____ and [3] ____ levels that make it unsafe for human consumption or for the natural environment. It can be treated after its use in a [4] ____ tank, a [5] ____ pond or lagoon, or at a [6] ____ water treatment plant. In this type of plant, wastewater goes through several stages for its disinfection. First, large debris is removed by filtering water through a [7] ____. Second, water passes to a [8] ____ tank to stay undisturbed for several hours and for heavy particles to settle. Third, water passes to the [9] ____ where organisms decompose the remaining organic matter. Finally, water is disinfected with [10] ____ and the [11] ____ is discharged into the natural environment.

② **Complete the chart with possible measures to prevent water pollution at home.**

Household Measures to Prevent Water Pollution			
		Don't flush medications down the toilet. Instead, place them in a trashcan or take them to a collection center.	

③ **What can happen to fish habitats when wastewater with 700 mg/l TSS is discharged directly into natural bodies of water? Read and complete.**

Project

What Effect Does Water Pollution Have on a Community?

In this project, you will discover the effect that polluted water can have on a community.

Stage 3: Share your project

1. Use the chart from stage 2 on page 77. Create a poster.
   a Divide a poster board into three columns.
   b Write the facts you gathered from research about the three types of pollutants and the effect on the community.
2. Present your project to the rest of the class.
   a What effect does water pollution have on health, hunger, and poverty in the region that the river serves?
   b Which is the worst effect water pollution has on the community? Why?

Stage 4: Evaluate your project

1. Ask your classmates to evaluate your presentation.
   a Is the information clear?
   b Do you make eye contact with your audience when you speak?
   c Do you give your audience time to ask questions at the end of your presentation?
   d Are there any spelling or punctuation mistakes in your poster?
2. What did you learn from your research and presentation? What would you do differently?

Water pollution has the worst effect on ... in this community because ...

UNIT 1

Unit Review

1. Go back and watch the video ▶
2. Now complete the activities on your **Video Worksheet**

UNIT 2

What Mixtures Are There in Our Environment?

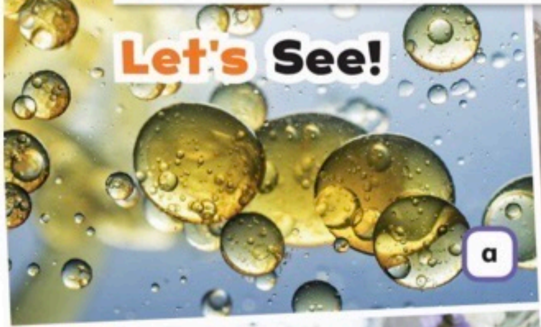
Watch the video

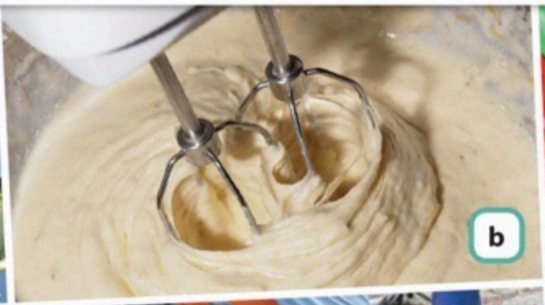
Lesson 1: How do mixtures separate?

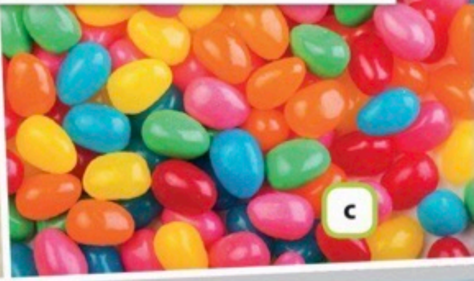
Learning Goals In this lesson, you will recognize the physical properties of materials that change when the materials are mixed.

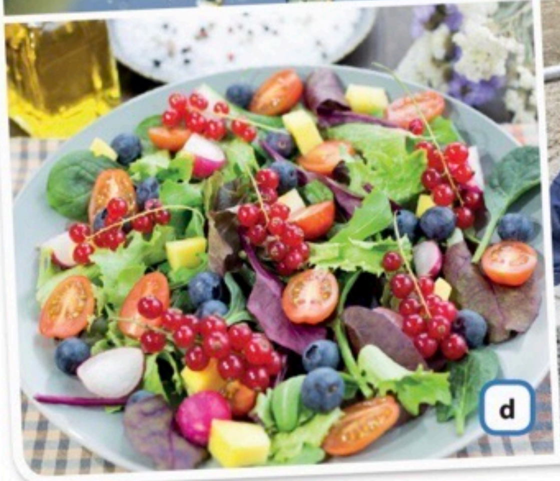
Inquiry Skills You will also classify mixtures.

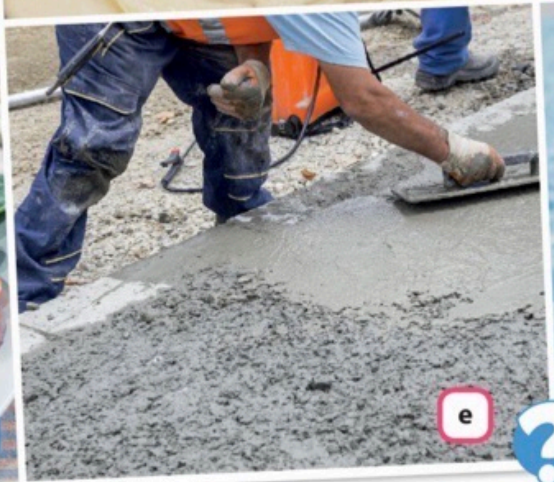
Let's See!

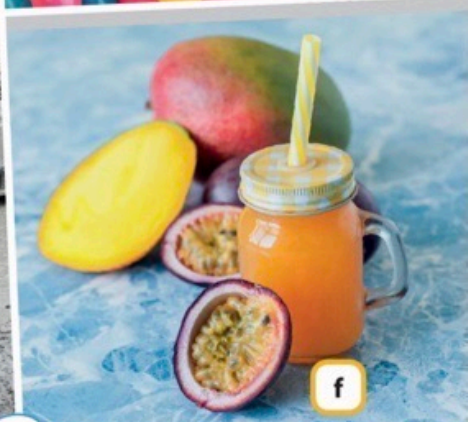












Did you know?
Blood is a mixture that can be separated into two of its main components: red blood cells and plasma.

① What mixtures can you identify? Write the letter next to the correct word.

e concrete
☐ water and oil
☐ cake mix
☐ fruit drink
☐ jelly beans
☐ salad

② Which mixtures can be easy or difficult to separate into the original materials? Why? Discuss with a partner.

... can be easy / difficult to separate because ...

Let's Try!

How Can Materials in a Mixture Be Separated?

1. Mix the water, gravel, sand, and salt in a beaker.
2. Place the sieve over a beaker and pour the mixture.
3. Place the coffee filter inside a sieve and pour the remaining mixture into the other beaker.
4. What materials are still in the water? Why? Can they be separated from water? Discuss with a partner.

... is/are still in the water because ...

The materials can/can't be separated because ...

Materials

- Three beakers
- Water
- Half a cup of gravel
- Half a cup of sand
- Half a cup of salt
- One stirring rod
- Two kitchen sieves
- One coffee filter

Let's Learn!

1 What are the similarities and differences between water and milk? Draw a Venn diagram in your notebook and compare the two substances. Then read and check.

Mixtures

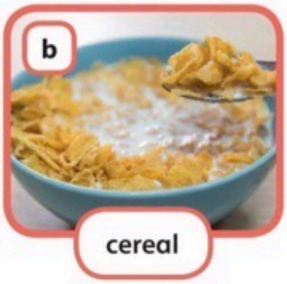
Our environment has all sorts of pure substances and mixtures. Pure substances, like water and oxygen, have only one component. Mixtures, on the other hand, have two or more components. Mixtures can be homogeneous or heterogeneous. Homogeneous mixtures look uniform. That is, we can't see the different components or substances in it. But, when we look at heterogeneous mixtures, we can actually see the different components. The components in a mixture retain their properties. But, when they are combined, they can have physical changes, such as texture, shape, color, odor, and state (liquid, solid, or gas).

2 Read again and classify the mixtures as homogeneous or heterogeneous.

Homogeneous	Heterogeneous

a

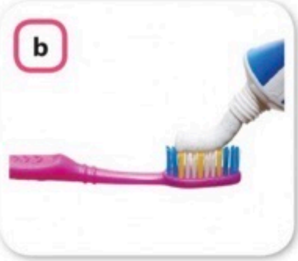
fog

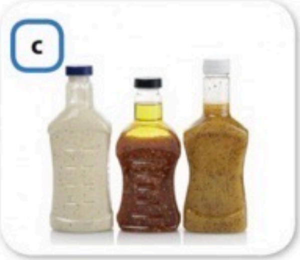

b

cereal

3 **What similarities and differences can you see? Explain to your partner. Then read and check.**

... and ... are similar / different because ...

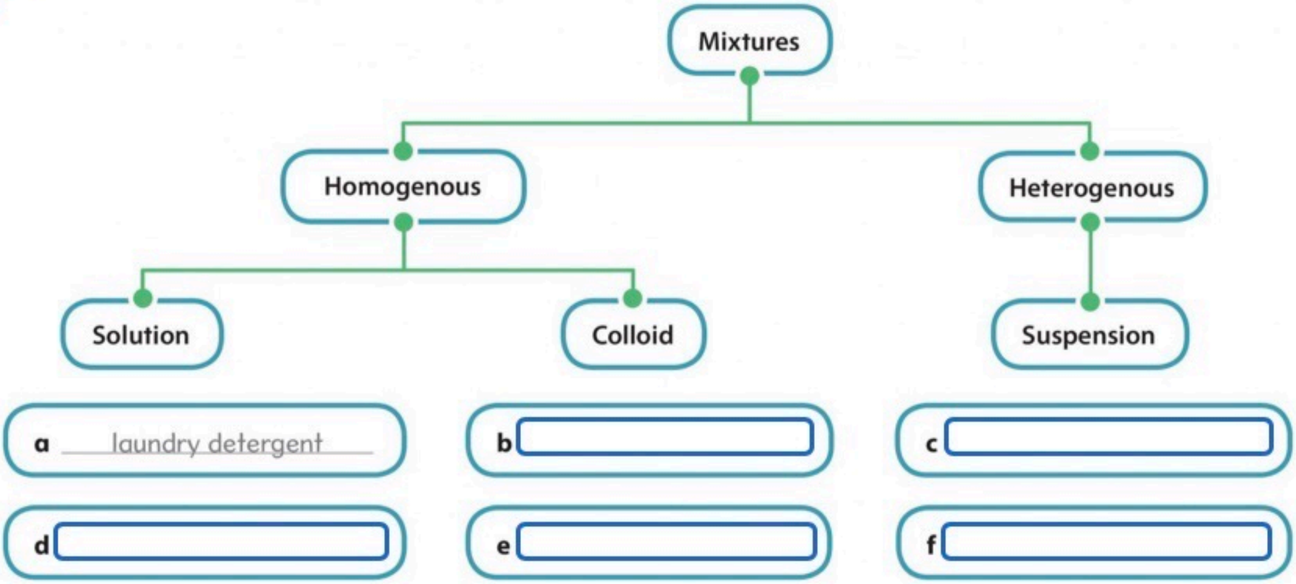




Colloids and Suspensions

We know that solutions are homogeneous mixtures formed by solutes and a solvent. Some examples of solutions are seawater and laundry detergent. There is another homogeneous mixture that is sometimes confused with solutions. That type of mixture is called a colloid. The difference between a solution and a colloid is that instead of having substances dissolved, colloids have tiny droplets, bubbles, or particles of a component suspended or distributed in another substance. Yet, the mixture looks uniform. Examples of colloids are gelatin, fog, smoke, milk, and toothpaste. In contrast, there is only one type of heterogeneous mixture, which is called a suspension. Suspensions are very common. As a matter of fact, they're the most common type of mixture found in our kitchens or on construction sites. Examples of suspensions are salad dressing, soups, and concrete.

4 **Read again and complete the tree diagram with words from the text.**



5 **Draw a tree diagram in your notebook and list at least three different mixtures for each type. Then explain to your partner.**

... is a solution / colloid / suspension because ...

6 **What combinations of states of matter can you find in the following mixtures? Match the pictures to the combinations. Then read and check.**

Liquid	Solid	Gas
☐ and liquid ☐	☐ and solid ☐	a and gas air
☐ and solid ☐	☐ and gas ☐	☐ and liquid ☐

7 **Read again and complete the chart in activity 6.**

Mixtures and States of Matter

Mixtures can be made of any combination of states of matter. Solutions are often formed by two liquids, such as cleaning fluid. But, suspensions can also be formed by two liquids, like oil (liquid) and vinegar (liquid) salad dressing. Colloids, for example, can be formed by liquid and solid, like gelatin, or by liquid and gas. An example is mist, where small droplets of water (liquid) are suspended in the air (gas). But, if the liquid comprises more than 50% of the mixture, then the mixture is gas in liquid. An example is mineral water, in which carbon dioxide (gas) is mixed with water (liquid). Pure air is an example of a gas-in-gas mixture. Mixtures can also be made with solids. Smoke is an example of a solid-in-gas mixture. The particles in smoke (solid) are mixed with air (gas). Finally, there are solid-in-solid mixtures, in which both substances are solids, as in the example of a salad.

8 **Classify the mixtures in activity 6 according to their type. Explain to your partner.**

Air is a homogeneous mixture formed by gases. And, it's a solution because ...

9 What are the scientists doing? Discuss in small groups. Then listen and check. 17

The scientists are ... What do you think?

10 Read and complete. Then listen again and check. 17

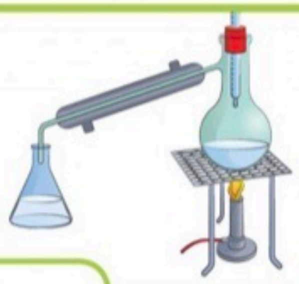
~~components~~ metals salts solids mixture gas water

Separation Method

There are different methods to separate the different [1] components that form a mixture. For example, evaporation can be used to separate the [2] ____ from the water in seawater by heating up the solution until water becomes a [3] ____ and evaporates. However, to collect the [4] ____, the solution needs to be heated in a closed container so that when the water evaporates, it condenses and it's redirected to another container. This method is called distillation. Suspended particles can be separated from a [5] ____ by filtration. That is, a filter is used so that the particles stay there. Another method called sieving can be used to separate [6] ____ of different sizes. Finally, [7] ____ can be separated from a mixture by the magnetic method.

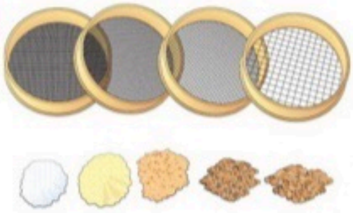
11 Complete the illustrations with words from the text.

a



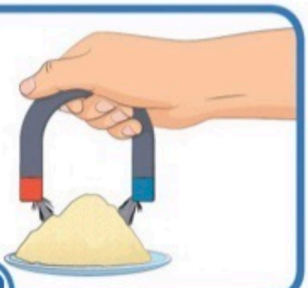
distillation

b



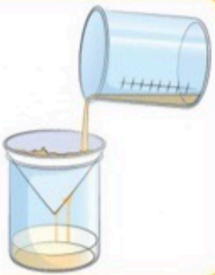
____

c



____

d



____

Let's Do It!

① An earthquake in Haiti destroyed houses and left the air polluted with dust and the water with debris. Help rescue squads fill out the call-to-action form with methods to separate components in those mixtures.

Problems		Possible Solution
	Many homes were destroyed. Some materials must be separated so that they can be recycled to build new homes.	Magnets can be used to separate some nails and screws.
	Water is needed, but rivers and lakes got polluted by debris.	
	The air is polluted with dust. Unfortunately, people will get sick if they continue breathing that air.	

② Circle some materials shown in activity 1 and classify them.

Homogeneous		Heterogeneous
Solution	Colloid	Suspension
	polluted air	

③ What physical changes did the materials in activity 1 go through after the earthquake? Explain to your partner.

Wood changed in shape and texture, but not in state because ...

Let's Show It!

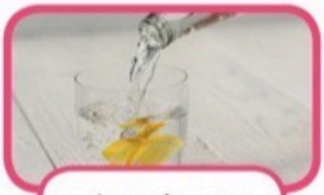
1 Read and complete.

~~pure~~ physical component suspensions heterogeneous colloids

Our environment has [1] ______pure______ substances and mixtures that we use every day. Pure substances are made up of only one [2] ______ and mixtures by two or more. Mixtures can be homogeneous or [3] ______. Solutions and [4] ______ are homogeneous mixtures, and [5] ______ are heterogeneous. That means that we can see the different components that form the mixture. The components in mixtures can undergo [6] ______ changes in texture, color, size, and state.

2 Classify the following mixtures and complete the chart.

gelatin

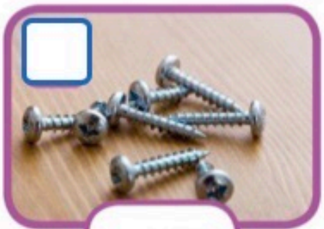

mineral water

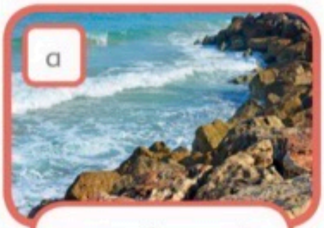
salad dressing

fog

Mixtures		
Homogeneous		Heterogeneous
Solution	Colloid	Suspension
mineral water	polluted air	salad dressing
liquid and solid		

3 Write the letter next to the correct separation method.


☐ screws


a water from salt

☐ tea from fruit

☐ smallest stones

a distillation **b** filtration **c** sieving **d** magnetic

Project

Are There Suspended Particles in the Air We Breathe?

In this project, you will discover the quality of air in your community.

Materials

- Petroleum jelly
- String
- Nine white index cards
- Hole punch
- Magnifying glass

Stage 1: Plan your project

1. Draw a rectangle in the center of each card.
2. Punch a hole in a corner of each card and tie a string to it.
3. Make a chart to record your data.

Place	Street	Park	Yard
Card 1	17		
Card 2	21		
Card 3	19		
Average	19		

Stage 2: Develop your project

1. Make a chart to organize your data.
2. Spread a thin layer of petroleum jelly on the rectangle and hang the cards. Let the cards hang for five days.
3. Collect the cards one at a time and use the magnifying glass to count the number of particles you find on the rectangle.
4. Record your data.
5. Calculate the average number of particles per location.

UNIT 2

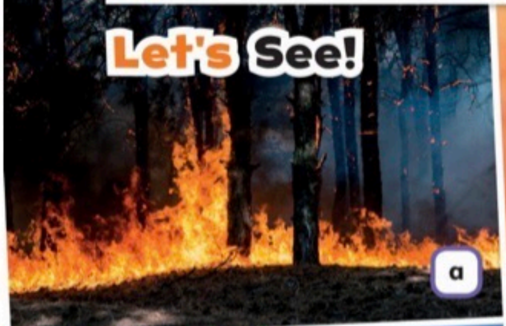
What Mixtures Are There in Our Environment?

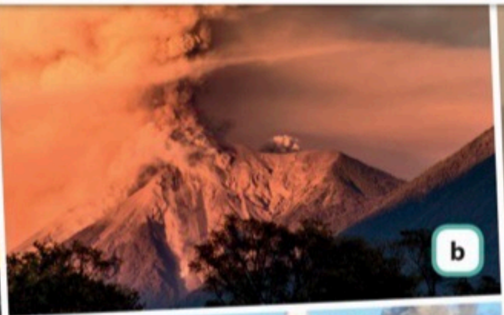
Lesson 2: How can we care for our atmosphere?

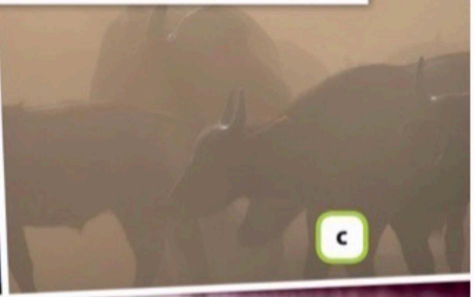
Learning Goals In this lesson, you will identify air as a mixture and propose actions to prevent air pollution.

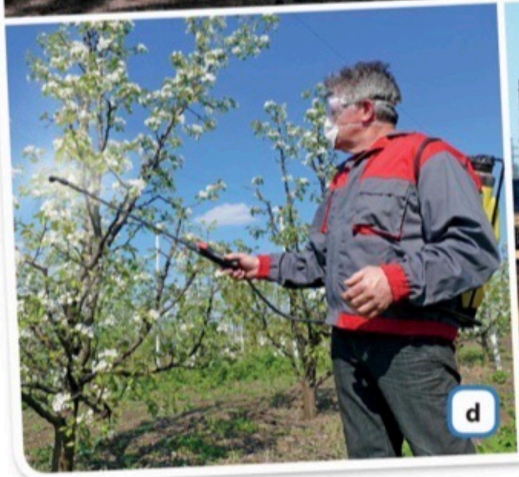
Inquiry Skills You will also classify air pollutants and their main sources.

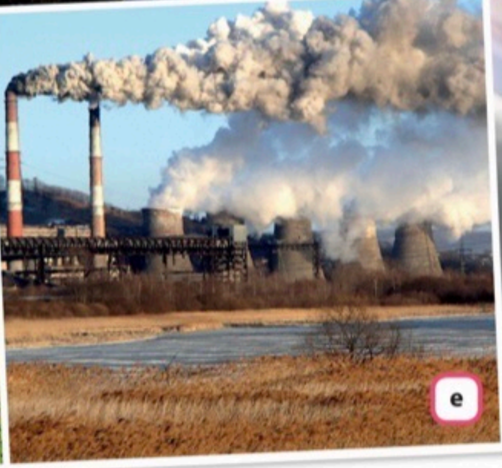
Let's See!

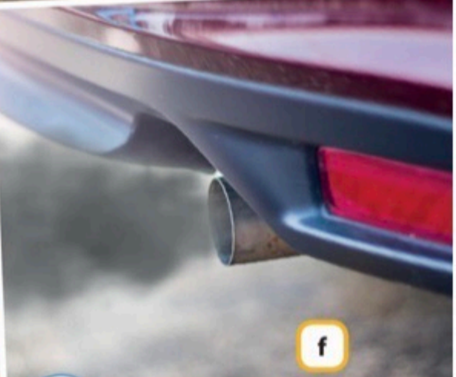












Did you know?
Air pollution around cities can be seen from outer space.

① What are some sources of air pollution? Match the pictures to the sources.

Natural Sources	Human Sources
b volcanic activity	☐ car fumes
☐ dust storms	☐ agricultural pesticides
☐ forest fires	☐ industrial fumes

② **Is the air that you breathe clean?**

The air that I breathe is/isn't clean because ...

Let's Try!

How Do We Pollute Air?

1 In small groups, pour one drop of yellow food coloring into the water for each person who showered in the morning, blue for having breakfast, and red for arriving to school by bus or car.

2 What happened to the water? What does that mean for air pollution? How do you pollute the air with your daily activities? Discuss in small groups.

I pollute / don't pollute the air with those daily activities because ...

Materials

- One transparent plastic cup

- Water
- One dropper

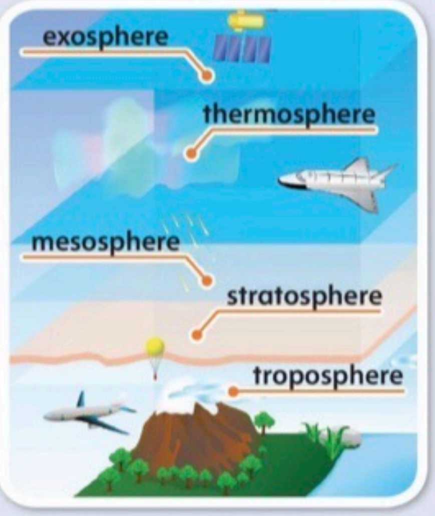
- Food coloring (yellow, blue, and red)

Let's Learn!

① **What's in the Earth's atmosphere? Read and answer.**

Colloids and Suspensions

The Earth's atmosphere is divided into layers. The troposphere, which is the layer closest to the ground, has a mixture of gases. This mixture is made of about 78% nitrogen (N_2), 21% oxygen (O_2), and 0.93% argon (Ar), and it also has small amounts of carbon dioxide (CO_2), other gases, and water vapor. The next layer after the troposphere is called the stratosphere. Here, there's another gas called ozone (O_3) that protects the Earth from harmful ultraviolet (UV) radiation from the Sun. But, the ozone found in the troposphere, or ground-level ozone, can damage our health. It's actually a major component of smog.



② **Read again and complete the chart.**

	Stratosphere
nitrogen (N_2)	protective layer of
oxygen (O_2)	
argon (Ar)	

③ **Why is O_3 protective in the stratosphere, but harmful in the troposphere? Discuss with a partner.**

Ozone is helpful in the stratosphere, but harmful in the troposphere because ...

4 **Which of the following pollutes air more? Compare and discuss in small groups. Then read and check.**

... pollutes air more than ... because ...

a

b

c

Air Pollution

Most human activities tend to cause air pollution to some extent. One of the primary sources of air pollution is burning fossil fuels like coal, diesel, and gasoline. To generate electricity, many power plants use coal or oil. Combustion of fossil fuels releases several pollutants such as nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and carbon monoxide (CO). NO_2 is formed mainly by the emissions from trucks, buses, cars, and power plants. Most SO_2 is generated by the emissions from power plants and industrial factories. And, CO is released into the air mostly by motor vehicle exhausts from cars, trucks, buses, and motorcycles. NO_2, SO_2, and CO are dangerous and the cause of many serious respiratory illnesses. Volatile organic compounds (VOCs), on the other hand, are air pollutants that get released into the air as gases from solids or liquids like paints, lacquers, pesticides, cleaning supplies, daily hygiene products, glues, permanent markers, and adhesives. Another source of air pollution is called particulate matter (PM). PM is a mixture of tiny airborne solid particles or liquid droplets caused by dusty industries, forest fires, and by gases emitted by power plants or industrial facilities. PM can be inhaled and may cause serious damage to the lungs.

5 **Read again and complete the table with words from the text.**

NO_2	SO_2	CO	VOCs	PM
			pesticides	
	power plants			

6 **Circle as many sources of air pollution as you can find in the pictures in activity 4. Then explain to your partner how they cause air pollution.**

Producing a ... is a source of air pollution because industries ...

7 What are industries and governments doing to prevent air pollution? Read and complete.

~~alternative~~ fuels electicity wind sunlight energy

Air Pollution

Governments and industries alike are searching for [1] alternative and renewable sources of energy to prevent air pollution.

a Solar power is one of the renewable sources that can be used to convert [2] ______ into electricity. Solar panels can be placed on buildings or on the ground. However, building and installing this technology is expensive.

b Geothermal power uses steam or hot water found inside the Earth to produce [3] ______ or for direct use. There are just a few power plants around the world using this technology that has few emissions.

c Wind power is used to generate electricity. Tall wind turbines, usually with three blades, are placed in windy areas to take advantage of a strong and steady flow of [4] ______.
This technology doesn't pollute the air.

d Biomass power is used to generate electricity and fuel. The sources of this power come from the [5] ______ stored in plants and seeds, wood and wood by-products, and the organic components in waste. The most common [6] ______ derived from plant sources are an alcohol named ethanol and biodiesel. These can greatly reduce vehicle and other engine emissions.

8 Read again and match the paragraphs to the pictures.

☐

☐

c

☐

9 **Which pictures show ways to reduce pollution? Discuss with your partner.**

... can prevent air pollution because ...

10 **Read and complete. Then listen and check.** 18

~~bicycles~~ unplug polluting concentration contaminants household fossil energy-saving

Reducing Air Pollution

It may seem almost impossible to avoid ^{1} polluting the air with our daily activities. But, there are some actions that can reduce emissions of PM, NO_2, and SO_2 caused by burning ^{2} ___ fuels. For example, reducing, reusing, and recycling waste creates fewer ^{3} ___ than producing new bottles, cans, plastic bags, or containers. Moreover, there are ^{4} ___ bulbs that can decrease the amount of electrical power we use at home. Likewise, it's important to turn off and ^{5} ___ all electrical appliances and electronic equipment when they aren't being used. Also, we can reduce the amount of VOCs in the air by the responsible use of ^{6} ___ products. This means that we use only the minimum necessary amount. Furthermore, we can reduce the amount of CO in the air if we limit the use of motor vehicles and, instead, walk or use ^{7} ___ for short distances, or carpool to go to work or school. Tropospheric, or ground level, O_3 levels will also be reduced by lowering the ^{8} ___ of VOCs and oxides of nitrogen in the air.

11 **Listen again and classify the pollutant emitted according to the source.** 18

Sources of Air Pollution		
Power Plant	**Household Products**	**Motor Vehicles**
particulate matter (PM)		
sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon dioxide (CO_2)		

Let's Do It!

It means that ...
What do you think?

① **Read the title of the article. What do you think it means? Discuss with a partner. Then read and check.**

Copperfield Fights Back

Copperfield is a small city surrounded by two volcanos. Recently, the local hospital began reporting a lot of cases of children and the elderly having serious respiratory illnesses. Therefore, the local government sent scientists to investigate the situation. The scientists found elevated amounts of four major air pollutants. They said that they found the following average concentrations per hour: carbon monoxide (CO) at 45 ppm, ozone (O_3) at 0.32 ppm, and nitrogen dioxide (NO_2) at 0.29 ppm. They also found that there was an average concentration of sulfur dioxide (SO_2) of 0.38 ppm. The scientists reported that the nearby power plant was responsible for the emissions. The local government plans on shutting down the plant and is currently looking for scientists willing to help them find the best alternative source of energy to produce electricity. Copperfield has an average of 110 sunny days and 226 (19.8 km/hr) windy days per year. And, since it's an agricultural town, they produce an average of 958 tons of organic waste per year.

② **Read again and complete the chart.**

National Air Quality Standards	**Human Sources**			
	CO			
	35 ppm	0.12 ppm	0.21 ppm	0.14 ppm
Copperfield	35 ppm	0.32 ppm	0.29 ppm	0.38 ppm

③ **Help Copperfield's local government choose the best alternative source of energy. In small groups, complete the chart.**

Alternative Sources of Energy			
Solar Power	**Geothermal Power**	**Wind Power**	**Biomass Power**
Advantage:	The city has volcanos nearby.		
Disadvantage: The city has about 110 sunny days/yr.			

Let's Show It!

1 **Read and complete.**

sulfur dioxide volatile organic compounds (VOCs) ~~atmosphere~~ emissions ozone troposphere fossil fuels particulate matter nitrogen dioxide

The Earth's ^{1} atmosphere is divided into several layers. The closest layer to the ground is called the ^{2} ______. Here, the air may be polluted by gases and harmful particles caused by burning ^{3} ______. Electricity-generating plants using fossil fuels have high ^{4} ______ of gases such as ^{5} ______ (SO_2), ^{6} ______ (NO_2), and also, ^{7} ______ (PM). Also, ^{8} ______ pollute the air since they are emitted as gases from solids or liquids. The main component of smog is ^{9} ______ (O_3).

2 **Classify the following sources of air pollution by one type of contaminant they emit.**

~~power plants~~ dust motor vehicles (x2) pesticides

Air Pollutants				
NO_2	SO_2	CO	VOCs	PM
______	power plants	______	______	______

3 **Write some advantages and disadvantages for the alternative sources of energy.**

Alternative Sources of Energy			
Solar Power	Geothermal Power	Wind Power	Biomass Power
Advantages			
______	______	______	Waste can be used to generate electricity.
Disadvantages			
During winter, there are fewer hours of sunlight.	______	______	______

Project

Are There Suspended Particles in the Air We Breathe?

In this project, you will discover the quality of air in your community.

Stage 3: Share your project

1. **Look at your analysis in stage 2 on page 93 of your project and take notes.**
   - **a** What location had the greatest amount of particles?
   - **b** What do you think is the source?
2. **Write to your local government recommending possible air pollution prevention methods.**

> Dear local government,
> I recently did an experiment on air quality and found that in a location named ... there were some particles that are polluting the air. People in the community should work together to prevent air pollution. Some prevention methods are ...

Stage 4: Evaluate your project

1. **Ask a classmate to evaluate the recommendations you made in the letter.**
   - **a** Is the information clear?
   - **b** Are the proposed air pollution prevention methods suitable for the community?
   - **c** Are there any spelling or punctuation mistakes?
2. **What did you learn from your research and letter? What would you do differently?**

UNIT 2

Unit Review

1. Go back and watch the video
2. Now complete the activities on your **Video Worksheet**

What Have You Learned?

1. Go back to page 69. Write more words for each picture. Which picture has the most words?

2. Discuss these questions.

Why is water important for our planet?

What mixtures are there in our environment?

Do You Want to Know More?

You can learn more and play interactive games about water at this fun site: http://www.sciencekids.co.nz/water.html

Take a virtual tour of a water treatment plant or play scramble and matching games at this site: http://water.epa.gov/learn/kids/drinkingwater/gamesandactivies.cfm

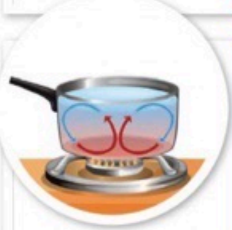
Turn the kitchen into a fun science lab with the help of an adult and do experiments with mixtures using ideas found at this site: http://kidsactivitiesblog.com/9961/science-mixing-solutions

You can learn more about the atmosphere and air pollution at this site: https://www.ducksters.com/science/environment/air_pollution.php

BLOCK 4

Energy and Forces

Find the words for each picture.



decibels (dB)
non-renewable sources of energy
chemical burns
radiation burns
Newton (N)
variables
weight
matter
temperature
electric energy
Joule (J)
auditory nerve
electric circuit
electric current
echo
gravity
thermal conductors
thermal energy
thermal insulators
theremometer
atom
attract
conductors
sound
stirrup
electrocution
eardrum
anvil
amplitude
escape velocity
freezing point
heat
molecules
thermal burns
mass
negative charge
Law of Universal Gravitation
protons
repel
chemical changes
positive charge
parallel circuit
conduction
power source
open circuit
cochlea
closed circuit
insulators
electrons
renewable sources of energy
ocean currents
degrees Celsius (°C)
radiation
switch
static electricity
boiling point
energy
wave
potential energy
freefalling
resistance
resistor
wavelength
convection
pitch
pinna
ultrasound
frequency
hammer
force of attraction
vibration
gravitational potential energy (PEgrav)
intensity
propagate
reflection
noise pollution,
hammer
infrasound
Hertz (Hz)
infrasound
earplugs
medium
ear canal
frequency
echo
noise pollution

UNIT 1

Is There Only One Kind of Energy?

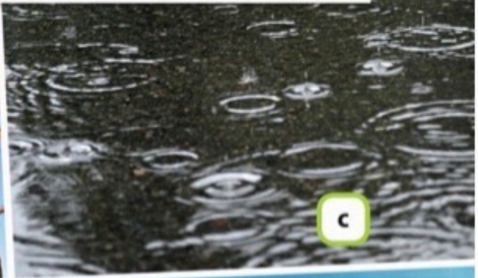
Watch the video

Lesson 1: Why do astronauts seem to float?

Learning Goals In this lesson, you will describe the concept of energy and its types, and identify the relationship between natural phenomena and gravity.

Inquiry Skills You will also manipulate variables.

Let's See!



Did you know?
Energy cannot be created or destroyed. It can only be transformed.

① What actions can you identify? Match the pictures to the correct words.

- e jumping
- ☐ raining
- ☐ parachuting
- ☐ falling leaves
- ☐ falling water
- ☐ diving

② What do the actions have in common? What makes that happen? Discuss with a partner.

All of them are ... And, what makes that happen is ... because ...

Let's **Try!**

How Does Energy Transform?

1 In pairs, tie one end of the string to the middle of the pen.

2 Hold the other end of the string and fully extend your arm in front of you. Have your partner hold the pen away from you, to the left or right, and then release the pen.

3 Observe the motion of the pen. Why does the pen swing back and forth? Why does it stop swinging? Discuss with your partner.

Materials

- One meter-long string

- One pen

The pen swings back and forth, and then it stops swinging because ...

Let's **Learn!**

1 **Read the dictionary definition.**
What do you think the missing word is?

1 *noun* – a person, object, or place that you get something from

2 **Where does energy come from? Read and find the missing word in activity 1.**

Sources of Energy

Energy is a fundamental element in the universe and it is what makes things happen: from a plant growing to a space shuttle going to the moon. Scientists define energy as the ability to do work, or even change the chemical or physical properties of matter. Matter is everything that exists and that occupies space and has mass. And, matter needs a source of energy to do work. Non-renewable sources of energy are those that cannot be easily replenished because it takes nature an extremely long time to create them, such as fossil fuels (coal, oil, and gas), and uranium. Renewable sources of energy are available in nature in unlimited quantities, like solar, wind, biomass, and geothermal power.

3 **Read again and complete the chart with words from the text.**

Energy Sources	
Renewable	**Non-renewable**
solar	coal

4 **In pairs, look at the pictures and complete the chart. Then read and check.**

Types of Energy

Potential	Kinetic
sleeping koala ______	______

Types of Energy

Energy types can be classified into two major categories: kinetic and **potential energy**. Kinetic energy is the energy of motion. Some forms of kinetic energy are electrical, sound, and thermal. Potential energy is the energy present in matter which results from its formation or position. There are many forms of potential energy, such as chemical energy, which is found in batteries, petroleum, or food. Other forms of potential energy are mechanical, nuclear, and gravitational. **Gravitational potential energy (PE_{grav})** is the energy present in matter that depends on two **variables**: the mass of the object and its position (height). And, it is also determined by **gravity**, which is the **force of attraction** between two objects. PE_{grav} for our planet can be expressed as $PE_{grav} = m$ (mass) × g (9.8 m/s^2 gravitational acceleration constant on Earth) × h (height). The unit of measurement of PE_{grav} is the **Joule (J)**.

5 **Read again and complete the sentences with words from the text.**

A variable is a condition, or factor, that can be manipulated, or [1] changed. In calculating gravitational [2] ______ energy (PE_{grav}), gravitational [3] ______ (g) is considered a constant factor on Earth with an approximate value of 9.8 meters per second squared (m/s^2). However, the two variables in PE_{grav} are [4] ______ and [5] ______.

6 **Look at activity 4, picture b. Giselle's mass is 48 kg. She is standing on a diving board that is 1.5 meters high. What is her PE_{grav} if she stands on a diving board that is 2.5 meters high? Calculate the new PE_{grav}.**

Giselle's current $PE_{grav} = 48\ kg \times 9.8\ m/s^2 \times 1.5\ m = 705.6\ J$

Giselle's new PE_{grav} = ______ J

7 **Do we weigh the same on Earth as on the moon? Discuss in small groups. Then listen and check.** 19

We weigh/don't weigh the same on Earth as on the moon because ...

8 **Read and complete. Then listen and check.** 19

~~objects~~ mass away measured same more

The Law of Universal Gravitation

The Law of Universal Gravitation describes an existing attraction, or gravitational force, among [1] ____objects____ in the universe which decreases when the distance between the objects increases. That is, the farther [2] ________ the objects are, the lower the gravitational force. And, the closer their proximity, the stronger the gravitational force is. It also explains that the gravitational force is greater the [3] ________ mass an object has. Therefore, an object as massive as the Earth has quite a strong gravitational force. Mass refers to the amount of matter there is in an object and is [4] ________ in kilograms (kg). Weight, on the other hand, refers to the force of gravity pulling an object toward the center of another, and its unit of measurement is the Newton (N). Weight on the Earth can be expressed as $W = g \times m$, or $W = g\ (9.8\ m/s^2) \times m$ (mass in kilograms). But, since the moon has less [5] ________ than the Earth, it has a lower gravitational force. And, therefore, the mass of an astronaut remains the [6] ________ while his/her weight on the moon would be about one-sixth (1/6) or 0.17 of that on Earth.

9 **Calculate your weight on Earth.**

My weight on Earth = ____$9.8\ m/s^2$____ × ________ kg = ________ Newtons (N)

10 **Assume that you are an astronaut who has just landed on the Moon. Calculate your weight on the moon.**

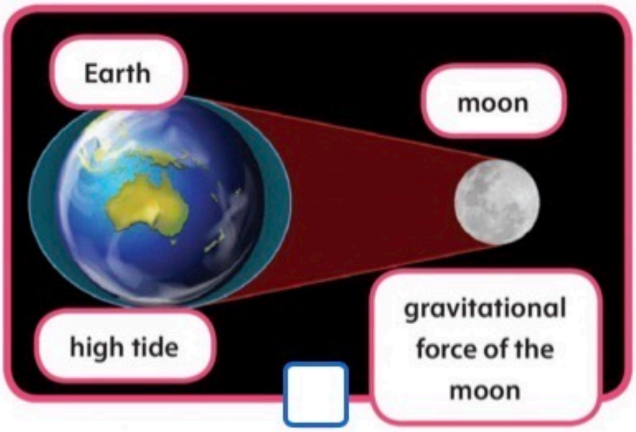
My weight on the moon = ____0.17____ × ________ Newtons (N) ________ = Newtons (N)

11 **What are the variables in activity 9? Which variable was changed in activity 10? Discuss with a partner.**

The variables are ... And, the variable that changed was ... because ...

⑫ **Match the words to the pictures. Then read and check.**

☐



☐

☐

a ocean currents **b** freefalling **c** escape velocity

Types of Energy

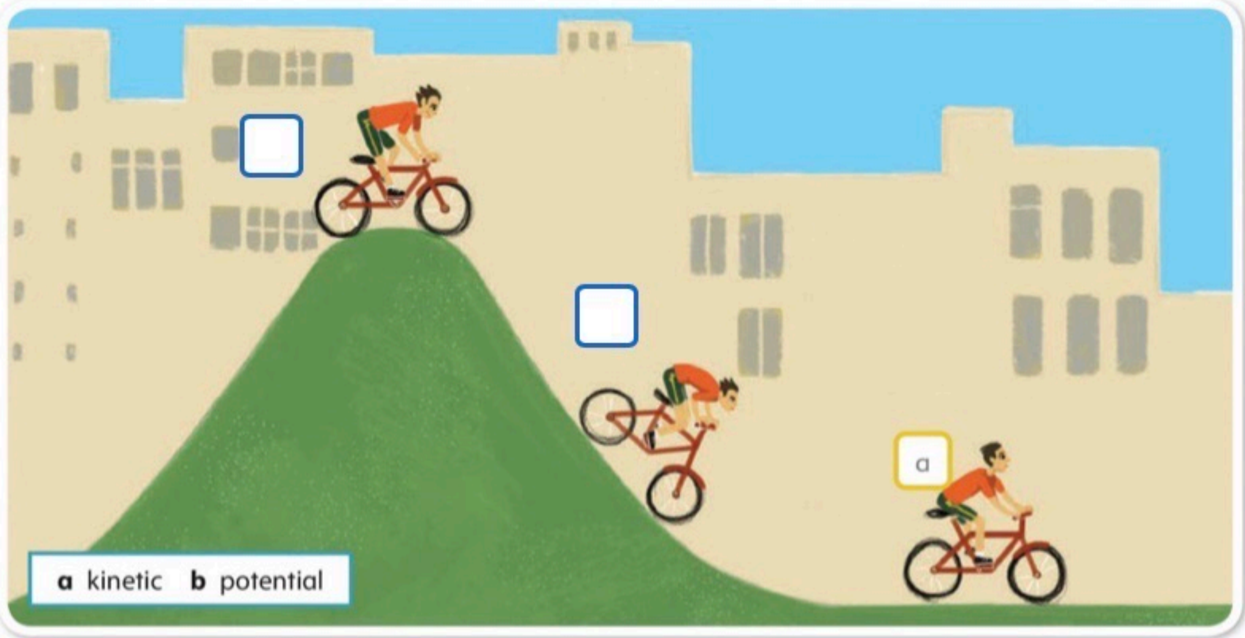
According to scientists, gravity is a fundamental force and is everywhere in the universe. Even the movement of water in Earth's oceans is affected by it. Ocean currents are determined by the rise and fall of tides in the ocean. This rise and fall is driven by the force of attraction, or gravity, between the moon and the Earth, as well as the sun. This movement is essential for climate and for keeping a balance of life on our planet. The importance of gravity and its effects, and the mysterious workings of the universe have kept scientists so fascinated that many space explorations have been conducted. But, launching a rocket away from Earth to explore the universe is not a simple task. The Earth's gravitational field must be escaped to allow the rocket to fly into space. The speed necessary to break away from the gravitational force of an object is called escape velocity, and it depends on the object's mass. For example, to launch a space shuttle from Earth, the shuttle must travel at a speed of 11.2 kilometers per second (11.2 km/s), and from the moon, it requires a speed of 2.8 km/s. The difference in speed is because the Earth has more mass than the moon. So, when astronauts are in a rocket going toward the moon, even at such high speed, the Earth's gravitational force continues pulling them down to it. This state is called freefalling and it is what makes astronauts appear to float in space.

⑬ **If a rocket is launched from a planet with a mass greater than Earth's, will it require a higher escape velocity? Why? Discuss with a partner. Then read again and check.**

If a rocket is launched from a planet with a mass greater than Earth's, it will/won't require a higher escape velocity because ...

Let's Do It!

① **Jordan weighs 686 Newtons (N) and his bike weighs 114 Newtons (N). He is on top of a hill that is 5.6 m high. Match the type of energy to the picture.**



② **Calculate the gravitational potential energy (PE_{grav}) in activity 1.**

Jordan's mass = 686 N ÷ 9.8 m/s^2 = 70 kg

Bike's mass = 114 N ÷ 9.8 m/s^2 = ____ kg

Total mass = ____ kg + ____ kg = ____ kg

PE_{grav} = ____ kg × 9.8 m/s^2 × ____ m = ____ Joules (J)

③ **What variables can be manipulated, or changed, in activity 1? Why? Discuss with a partner.**

... can be manipulated, or changed, because ...

④ **In small groups, change the value of one variable in activity 1 and calculate the new PE_{grav}.**

New PE_{grav} = ____ kg × 9.8 m/s^2 × ____ m = ____ Joules (J)

⑤ **If Jordan goes to the moon, why will he feel like he is floating? Does it mean that he has less mass on the moon than on Earth? Write an explanation for Jordan.**

Let's Show it!

1 **Read and complete.**

~~energy~~ PE$_{grav}$ freefalling non-renewable potential
matter gravity escape velocity renewable mass

[1] ___Energy___ is a fundamental force in the universe and it is defined as the ability to do work. But, [2] ______ needs a source of energy to do such work, which can be found in [3] ______ or [4] ______ sources. Energy can be classified into two main categories: kinetic and [5] ______ energy. One form of potential energy, called gravitational potential energy ([6] ______), depends on the [7] ______ of two objects, their position (height) and on [8] ______, or the force of attraction between the objects. Gravity is the one force that makes launching a rocket into space quite difficult. That is because to break away from the Earth's gravitational force, an [9] ______ of 11.2 km/s is necessary. This gravitational force is what keeps astronauts in space in a state of [10] ______.

2 **Mischievous Itzik is standing on a tall building. He has placed two balloons full of water on the edge of the building, at twelve meters from the ground. The mass of one balloon is 0.25 kg and the other is 0.48 kg. Help Itzik choose the balloon with the highest value of gravitational potential energy. Calculate the PE$_{grav}$ of that balloon.**

PE$_{grav}$ = ______ kg × ___9.8 m/s^2___ × ______ m = ______ Joules (J)

3 **What is the weight of the selected balloon in activity 2? Calculate.**

Weight on Earth ___9.8 m/s^2___ × ______ kg = ______ Newtons (N)

4 **If Itzik throws a balloon to the ground, what type of energy will it turn into? Circle the correct answer.**

a potential b kinetic c gravitational potential

5 **If mischievous Itzik tries to throw a water-filled balloon while on the moon, will it hit the surface of the moon as it does on Earth? Write an explanation.**

Project

Why Does Launching a Rocket Create So Much Noise?

In this project, you will discover the effect that kinetic energy can have on our health.

Stage 1: Plan your project

1. **In groups, assign a set of the following questions to investigate:**
   - **a** When a rocket is launched into space and energy transformation happens (from potential to kinetic), what forms of energy are produced? Why are unprotected people (the general public) kept at a distance of about 5.6 km away from the rocket's launch pad?
   - **b** What sound intensity level can permanently destroy the human ear? What are the sound intensity levels and maximum exposure time for: airplane takeoff, fireworks, rock concert, and heavy city traffic?
   - **c** What impact can noise pollution have on human health? What can be done to prevent it?
2. **Make a chart to organize your data.**

Sound Energy Analysis			
Source	Intensity (dB)	Exposure Time	Distance
Airplane takeoff			
Fireworks			
Rock concert	110 dB	2 minutes	
Heavy city traffic			
Intensity (dB)			

Stage 2: Develop your project

1. **Do your research in the library or on the Internet. Record your data. You may start your search at this site:**
   http://www.nasa.gov/
2. **Share your data with your group.**
3. **Analyze your data. What effect do high sound intensity levels and noise pollution have on human health?**

High sound intensity levels and noise pollution ... affect / don't affect human health ... because ...

UNIT 1

Is There Only One Kind of Energy?

Lesson 2: What is sound and how does it work?

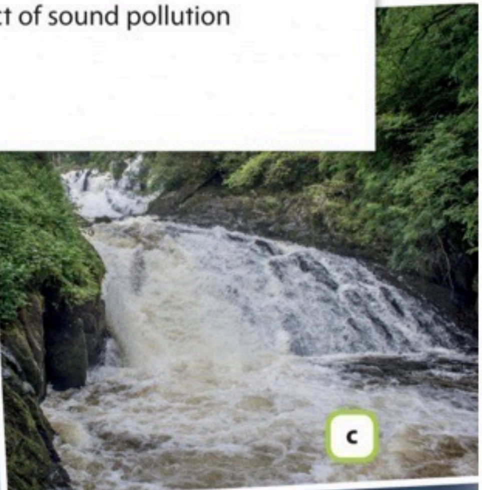
Learning Goals In this lesson, you will identify the relationship between the vibration of objects and sound propagation, and the impact of sound pollution on hearing.

Inquiry Skills You will also interpret sound wave graphs.

Let's See!

a

b


c

d

e

f

Did you know?
The smallest bones in the human body are inside the ear.

① **Match the pictures to the words. Then classify the sounds as loud (L) or not loud (N).**

e talking on the phone N ☐ water flowing ☐ ☐ playing the trumpet ☐

☐ helicopter flying ☐ ☐ thunderstorm ☐ ☐ laughing ☐

② **How do you know that a sound is loud? Discuss in small groups.**

I know that a sound is loud because it ...

Let's Try!

How Is Sound Produced?

Materials

- Three glasses
- Water
- One metal spoon

1 In pairs, pour different amounts of water in each glass.
2 Place the three glasses about two centimeters apart.
3 Tap each glass of water with the metal spoon. Observe and listen.
4 Did waves form in the water? Was the sound from each glass alike or different from the others? Why? Discuss with your partner.

Waves formed / didn't form in the water. And, the sound from each glass was alike / different because ...

Let's Learn!

① **Read and complete.**

waves ~~particles~~ objects energy have gas

Sound Waves

Sound is a wave, or disturbance, produced by the vibration of [1] ____particles____ in a substance. It is a form of kinetic [2] ________ in which energy is transferred through the longitudinal sound wave. Sound waves resemble the waves formed in still water when a pebble is thrown in. They propagate, or travel, through a solid, liquid, or [3] ________ medium, such as air or water. In fact, without a medium, sound can't be generated. The speed at which sound [4] ________ travel depends on the properties of the medium. Sound travels fastest in solids and faster in liquids than in gas. That is because the particles in solids are closer to one another than in liquids or gas. Sound waves also [5] ________ the ability to bounce back, or be reflected from [6] ________. The reflection of sound waves produces an echo in large, open spaces that lack small objects, such as in an empty room.

② **How is an echo produced? Discuss with your partner. Then read again and check.**

An echo is produced when ... because ...

3 **What are the properties of sound waves? Circle all that apply. Then listen and check.** 20

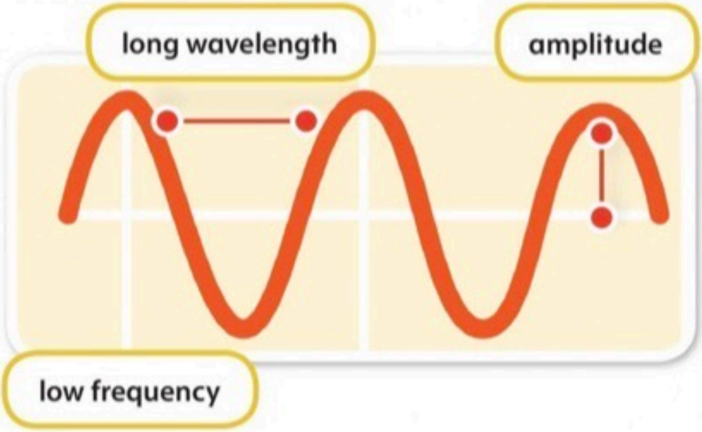
a velocity   b amplitude   c frequency   d wavelength   e noise

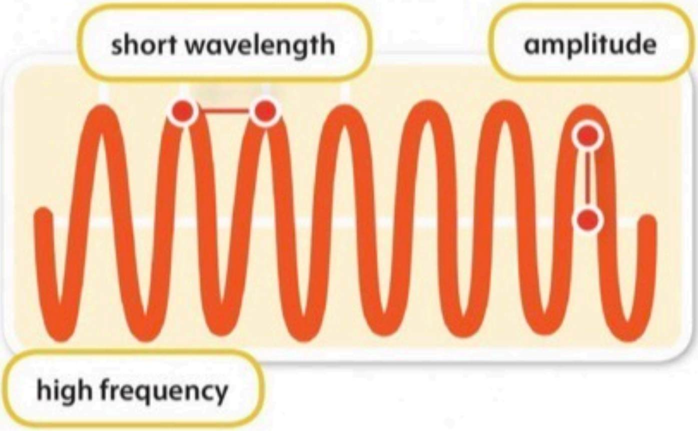
4 **Read and complete. Then listen again and check.** 20

~~waves~~ human distance sound frequency measured amount

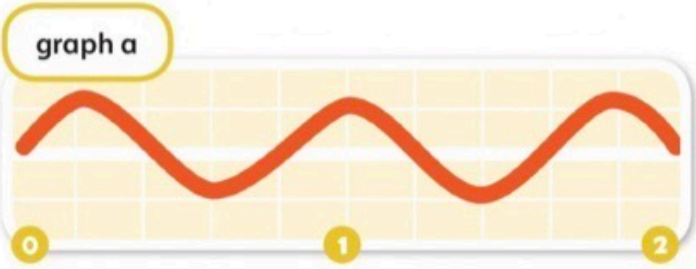
Properties of Sound Waves and Characteristics of Sound

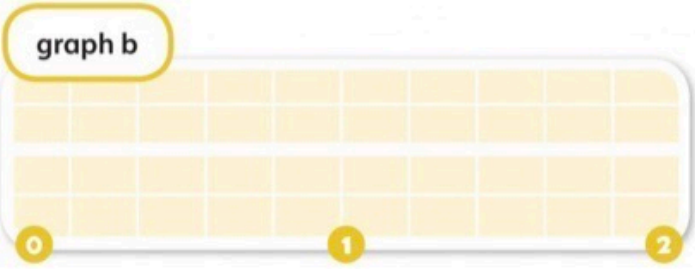
Scientists study sound through the behavior of sound waves. They have discovered that sound [1] waves have three properties: wavelength, frequency, and amplitude. Wavelength refers to the distance between the crests of two waves. That is the [2] ______ between the top points of two waves. Frequency describes the number of waves that pass a point in one second. Frequency is [3] ______ in Hertz (Hz). And, amplitude describes the [4] ______ of energy contained in a sound wave, or its volume. Amplitude is measured in decibels (dB). The properties of a [5] ______ wave determine two characteristics of sound, which are pitch and intensity. Pitch refers to the interpretation of the [6] ______ of a sound wave by the human brain. And, intensity indicates the amplitude of a sound wave, which is the [7] ______ brain's interpretation of the volume of the sound.





5 **In pairs, increase the frequency and amplitude of the sound represented in graph a. Draw the new sound representation in graph b.**





6 **What are the characteristics of the sound represented in activity 5, graph b? Compare the graphs and discuss with your partner.**

The sound in graph b has higher/lower pitch because ... And, it has a higher/lower intensity because ...

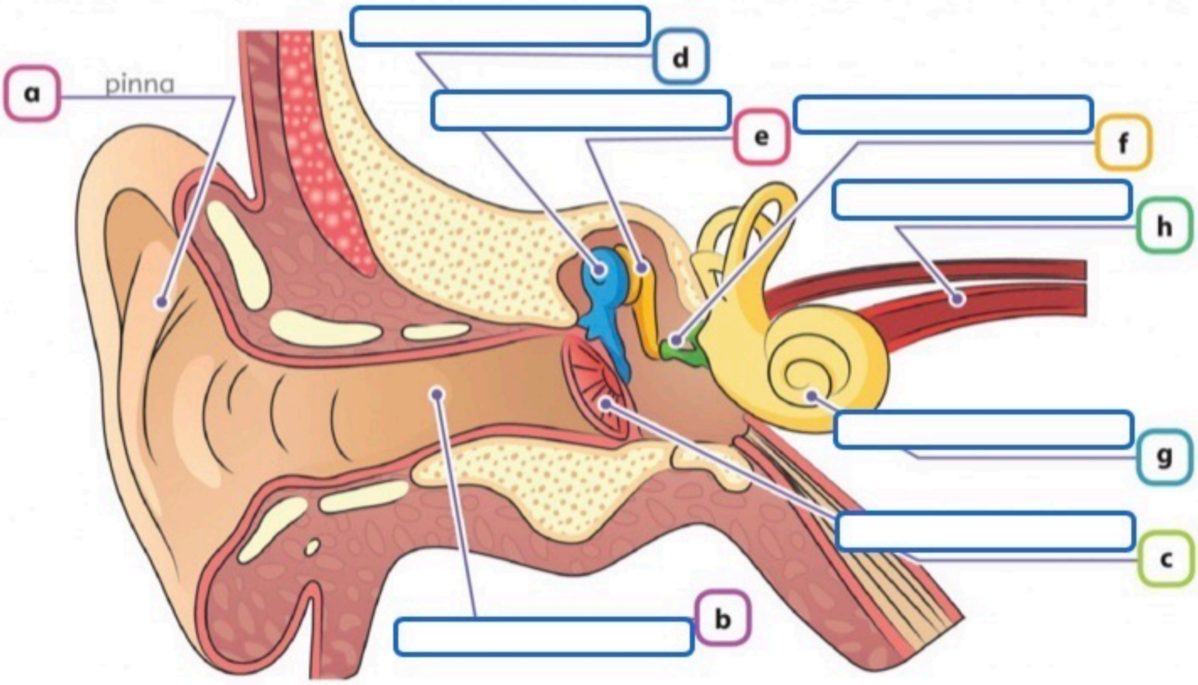
7 **How are we able to perceive sound, or hear? Discuss in small groups. Then read and check.**

We're able to perceive sound, or hear, when ... because ...

The Human Ear and Sound Perception

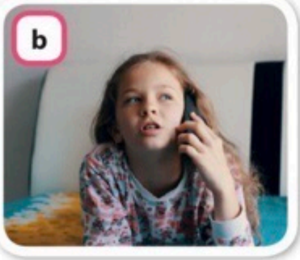
The human ear can perceive, or hear, sounds with frequencies from 20 to 20,000 Hertz (Hz). Any sound below 20 Hz that the human ear cannot perceive is called infrasound. Infrasound can be perceived by other species, such as elephants and dolphins. Ultrasound is any sound with a frequency of 20,000 Hz or more. The human ear cannot perceive ultrasound, either. However, bats, dogs, and cats can. The human ear perceives sound through vibration. That is, the sound wave enters the ear through the [a] pinna, where it passes through the [b] ear canal into the [c] eardrum. The sound wave makes the eardrum vibrate at the same frequency. The eardrum vibrations begin a vibration effect in three little bones, starting with the first one called the [d] hammer. Then, the hammer makes the [e] anvil vibrate. And the anvil makes the last one, the [f] stirrup, vibrate, too. Then, the vibration enters a fluid-filled structure called the [g] cochlea where tiny hair cells are set into motion, sending electric signals to the [h] auditory nerve for the brain to interpret the sound. The hair cells in the cochlea are delicate and can be permanently damaged in an instant by any sound reaching 130 or more decibels (dB), such as a gunshot, firecrackers, or a rocket launch.

8 **Read again and complete the illustration with words from the text.**



9 **Which sounds may be dangerous to our ears? Discuss with a partner. Then read and check.**

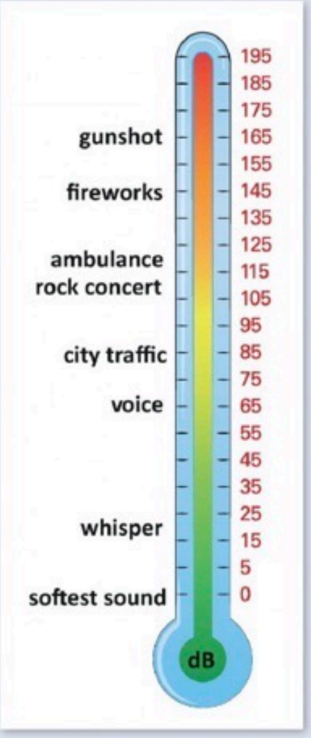
… may be dangerous to our ears because …



Noise Pollution

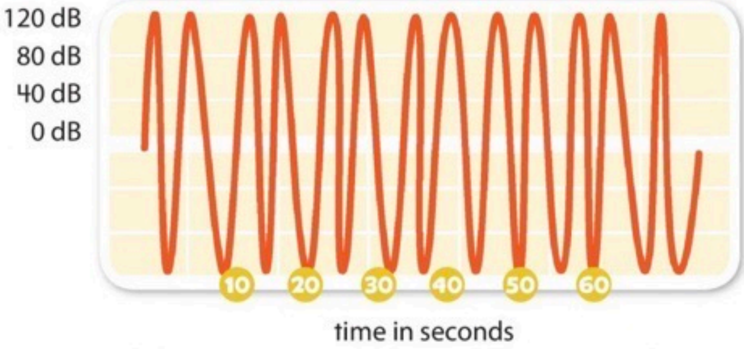
Noise pollution is considered to be any type of escalating and disturbing sound that might affect the health of a person. This negative impact on people's health may go from producing stress, high blood pressure, or hearing impairment, to complete deafness. So, to care for our health, it is important to recognize the volume level and length of exposure that our ears can safely manage. Scientists estimate that any sound that is 85 dB or above could damage our ears permanently if we are exposed to it for about eight hours or more.

But, any sound above 120 dB can begin damaging our ears in 15 seconds. And, sounds 130 dB or more, such as the sound of a plane taking off, can cause immediate damage. A typical rock concert is about 110 dB, which is a dangerous level for our ears if exposed to it for two minutes or more. The average human voice is about 65 dB. Caring for our ears can be as easy as moving away from the source of the noise, covering them with our hands or wearing protective earplugs.

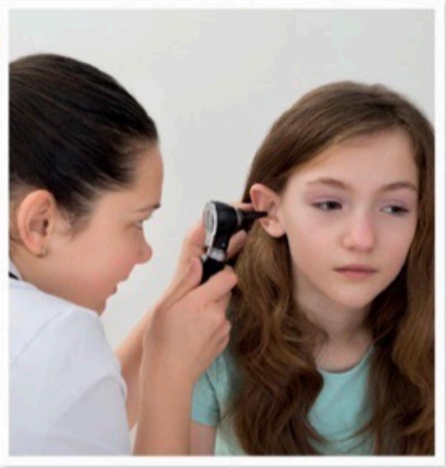


10 **What could happen to a person if he/she is exposed to the noise represented in the graph? Discuss in small groups. Then read again and check.**

The person could … because …



Let's Do It!

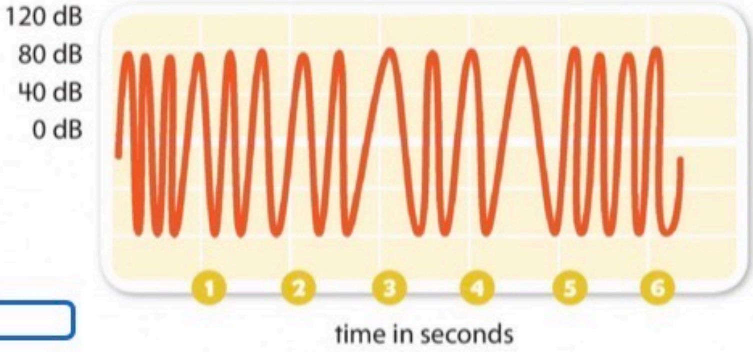


① Verónica enjoys jogging in the park every morning. She has a healthy lifestyle. However, she began complaining about headaches and ringing in her ears and went to the doctor, an audiologist. What do you think is wrong? Discuss in small groups. Then listen and check. 🔊 21

Verónica may have ... because ...

② In small groups, help Verónica's doctor interpret the sound graphs. Then listen again, check, and add the missing information. 🔊 21

graph a



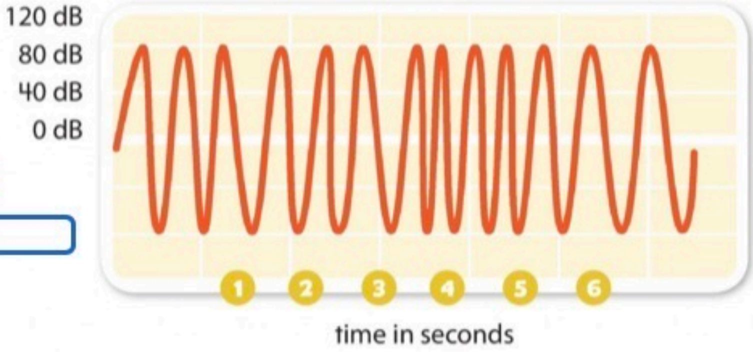
Source: MP3 player

dB:

Length of exposure: 2 hrs/day

Permissable exposure time:

graph b



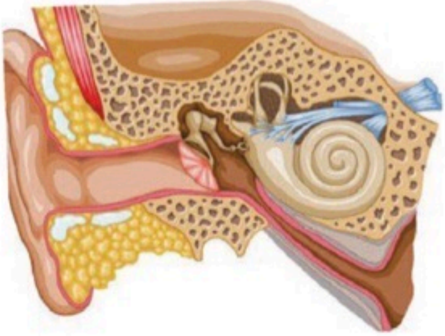
Source: rock concert

dB:

Length of exposure:

Permissable exposure time:

③ Help Verónica's doctor explain to her what the problem is and where it is located. Circle the area of the ear where the problem is located. Then write a reminder note to her with a brief explanation.



Verónica, don't forget that your ears were exposed to

a sound intensity

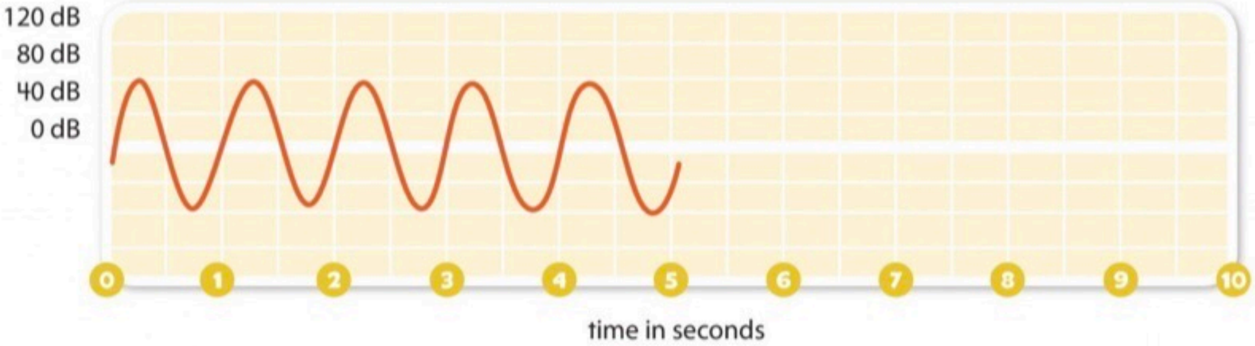
Let's Show It!

1 **Read and complete.**

noisepollution ~~sound~~ propagate amplitude medium wave ultrasound
vibration reflection frequency echo infrasound wavelength

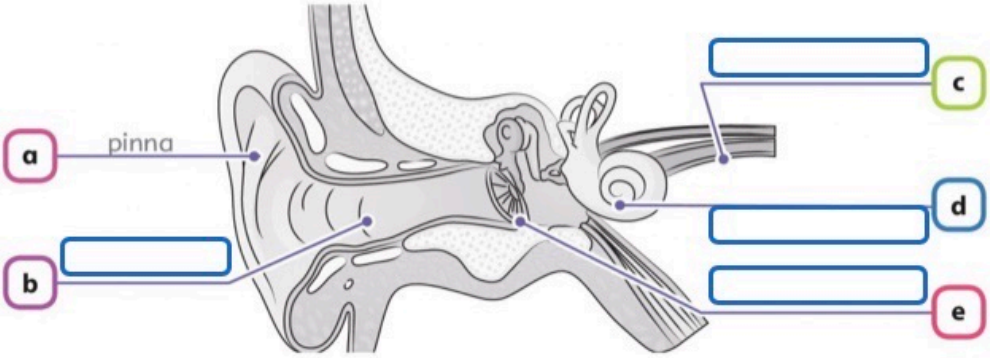
[1] Sound is a [2] ____ produced by the [3] ____ of particles in a substance. Sound waves [4] ____, or travel, through a solid, liquid, or gas [5] ____, such as air or water. Sound waves also have the ability to bounce back. Sound wave [6] ____ produces an [7] ____ in large, open spaces that lack small objects, such as in an empty room. Scientists have discovered that sound waves have three properties: [8] ____, [9] ____, and [10] ____. These properties of a sound wave determine two characteristics of sound, which are pitch and intensity. Intensity helps determine if a sound can be considered [11] ____ based on the level of decibels (dB). The human ear can perceive, or hear, sounds with frequencies from 20 to 20,000 Hertz (Hz). Any sound below 20 Hz is called [12] ____. And, [13] ____ is any sound with a frequency of 20,000 Hz or more.

2 **Complete the sound wave graph by increasing the amplitude to 30 dB and the frequency to 2 Hz.**



3 **Complete the illustration with words from the box. Then color in red the area where the hair cells are located.**

~~pinna~~
cochlea
ear canal
auditory nerve
eardrum



Project

Why Does Launching a Rocket Create So Much Noise?

In this project, you will discover the effect that kinetic energy can have on our health.

Stage 3: Share your project

1. **Take notes using the data you gathered and the analysis you made in stages 1 and 2 on page 111.**
   - **a** What sound intensity levels and sources can create health problems for children your age?
   - **b** Is noise pollution a problem in your community?
2. **Begin a noise pollution public awareness campaign by creating a poster with the facts you gathered and recommending possible prevention methods.**
   - **a** You can find ideas to create your poster at this site: https://www.youtube.com/watch?v=hkkUe8sKsxs
   - **b** Select a public location, such as a library or cafeteria, and request permission to hang up your poster.

Stage 4: Evaluate your project

1. **Ask a classmate to evaluate your poster and the recommendations you made.**
   - **a** Is the poster colorful and attractive?
   - **b** Are the proposed noise pollution prevention methods suitable for the community?
   - **c** Are there any spelling or punctuation mistakes?
2. **What did you learn from your research and from making the awareness poster? What would you like to learn more about or do research on?**

UNIT 1

Unit Review

1. Go back and watch the video ▶
2. Now complete the activities on your **Video Worksheet**

UNIT 2

How Does Energy Transform?

Watch the video

Lesson 1: How does an electric circuit produce light?

Learning Goals In this lesson, you will identify the functions and everyday applications of electric circuits.

Inquiry Skills You will also model electric circuits through diagrams.

Let's See!

Did you know?
Lightning is a release of electricity in the atmosphere.

① Match the pictures to the forms of kinetic energy.

Forms of Kinetic Energy		
Sound	Light	Heat
☐ listening to music	a lightning	☐ ironing
☐ talking on the phone	☐ working with computers	☐ using a hair dryer

② **Do the activities involve more than one form of kinetic energy? Why? Discuss in small groups.**

The activities involve / don't involve more than one form of kinetic energy because ...

Let's Try!

How Does Energy Transfer?

Materials

- Two balloons

- String

1 Inflate both balloons.
2 Rub both balloons on your hair and place them on a wall.
3 Tie each end of the string to each balloon. Hold the middle of the string and let the balloons hang. Observe.
4 Did the balloons stay on the wall? Why? What happened when you let the balloons hang from the string? Discuss with a partner.

The balloon stayed / didn't stay on the wall because ... They moved toward / away from each other when they were hanging because ...

Let's Learn!

① **Complete the illustration. Then read and check.**

a electron **b** protons and neutrons in the nucleus

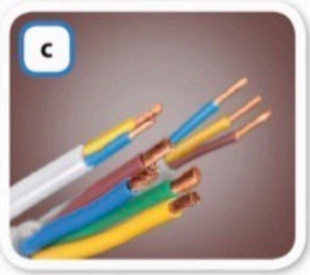
Atoms

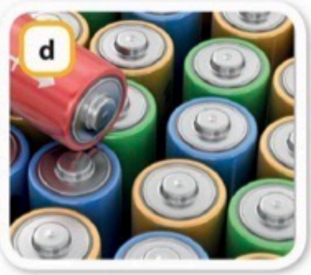
All matter in the universe is formed by the most fundamental element called the atom. An atom has three particles: protons and neutrons in its nucleus, and electrons traveling in orbits around the nucleus. Protons have a positive charge (+) and electrons have a negative charge (-). The positive and negative charges attract each other. The number of protons in an atom matches the number of electrons. But, electrons can move from object to object, usually through friction. When an object loses electrons, it becomes positively charged. If there are more electrons than protons in the object, it becomes negatively charged. Electrically charged things can attract or repel each other. Identically charged objects, (++) or (--), repel each other, or push each other away. If there is no flow, or movement, of electrons in a charged object, then the energy becomes static electricity.

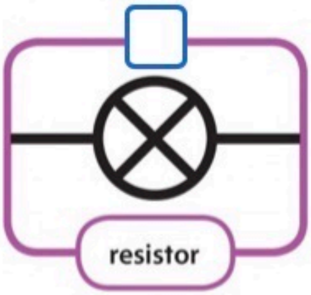
② **What type of charge does an object need to have to attract a positively charged balloon? Discuss with a partner. Then read again and check.**

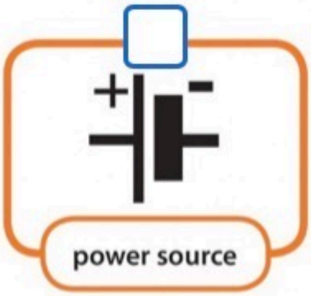
The object needs to have a ... charge to attract the positively charged balloon because ...

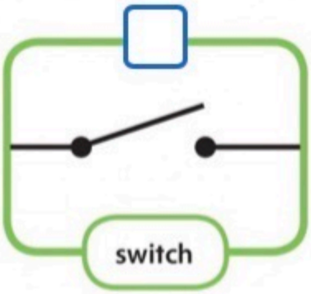
3 Match the pictures to the symbols. Then listen and check. 🔊 22

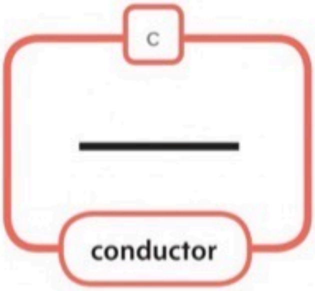












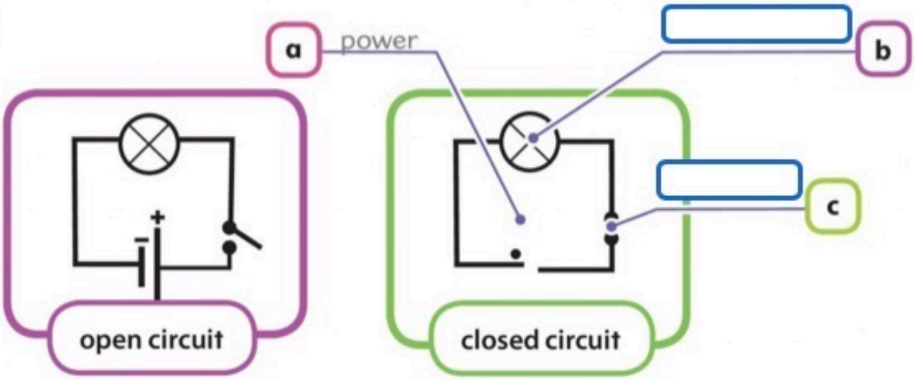
4 Read and complete. Then listen again and check. 🔊 22

~~electrons~~ electricity current property materials (x2) source

Electric Circuits

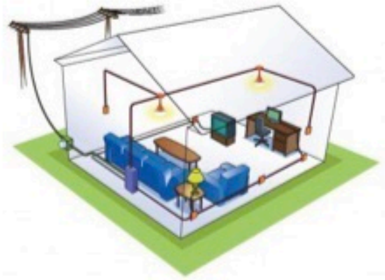
Electric current is the movement, or flow, of [1] electrons through materials. These [2] ______ can be conductors or insulators. Conductors are materials that allow the flow of electric current, such as metals. And insulators are those [3] ______ in which electric current cannot easily flow, like plastic, rubber, or wood. But, even conductors present a property called resistance. This [4] ______ determines how much a material opposes the flow of electrons through it. Resistance makes electric energy, or electricity, turn into heat. Electricity is a very useful [5] ______ of energy, and it can be transformed into other forms of energy through the use of electric circuits. An electric circuit is a device with several parts connected to make electric [6] ______ flow. An electric circuit needs a power source (like a battery), a conductor (metal wire), a resistor (the part that transforms [7] ______ into another form of energy, such as a light bulb), and a switch. Electric current flows through the circuit when the switch is closed, as in a closed circuit. In an open circuit, the current can't flow.

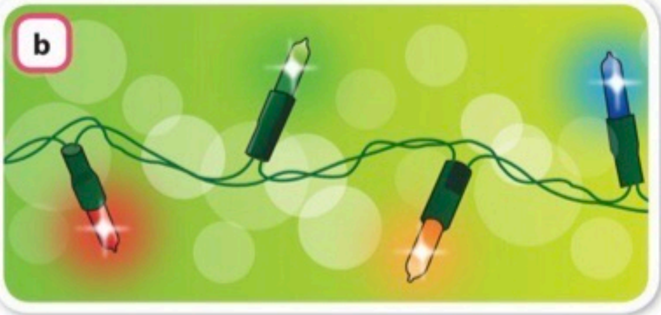
5 Use the symbols in activity 3 to complete the diagram of a closed circuit. Then label the diagram using words from activity 3.



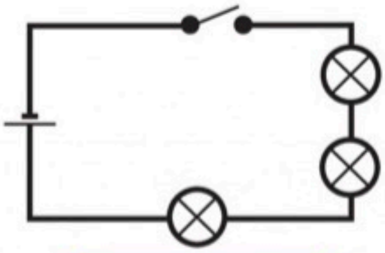
6 **Match the pictures to the diagrams. Then read and check.**

a



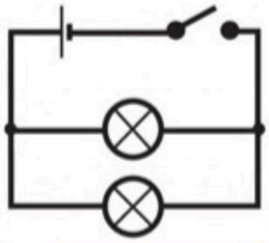


☐



series circuit

☐

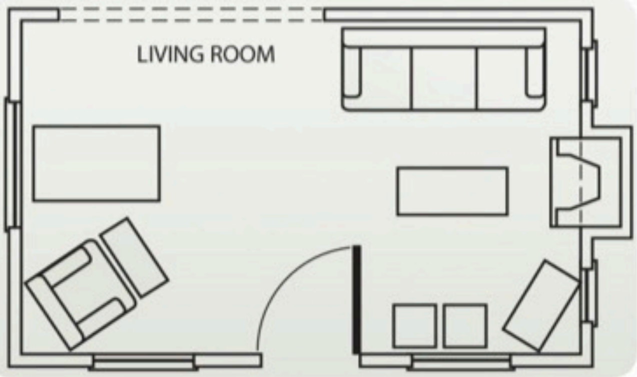


parallel circuit

Electric Circuit Applications

Electric circuits are widely used for everyday activities. A series circuit is one where the resistors are connected one after the other, such as in a string of Christmas lights. In a series circuit, the electric current must flow from resistor to resistor. But, in a parallel circuit, the resistors are connected between the same two points. That is, the electric current can flow into any of the branches. Parallel circuits are more efficient because the electric current can flow without disruption if one of the resistors is not working. Most houses have a parallel circuit design to distribute electricity among the rooms. As a matter of fact, most of the equipment and appliances we use every day have some form, or a combination, of series and parallel circuits. These appliances and equipment transform electric energy into other forms of energy. For example, an iron turns electric energy into heat, a light bulb turns it into light, an MP3 player turns it into sound, and a fan turns it into movement.

7 **Read again and draw a parallel circuit on the floor plan. Place two light bulbs in the room and a switch on the left side of the entrance.**



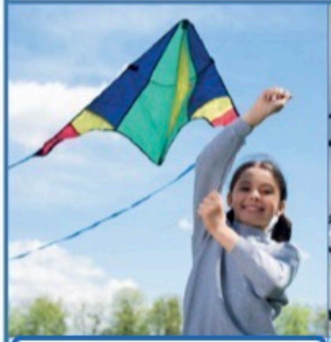
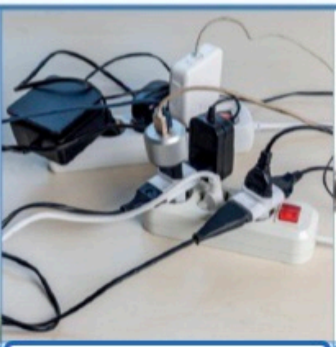
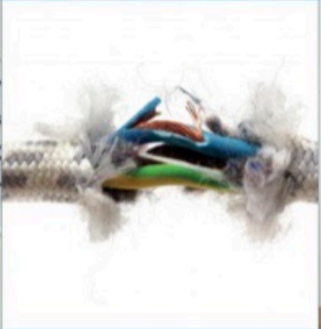
8 **Read and find the missing word.**

________ ***adjective*** – resulting in or causing death

Electricity and Safety

Electricity is an excellent source of energy, but it can be extremely dangerous. Electricity-related accidents can lead to burns, electric shock, and electrocution, which is fatal. The human body is an excellent conductor of electricity. And, when electricity is flowing through our bodies, it can interfere with the electric signals sent by the brain to muscles, such as the heart. This can cause spasms and make the heart stop beating properly, or it can cause the lungs to stop working. So, it is important to learn a few safety rules. First, do not plug several appliances in the same outlet or extension cord. This can overload the electric system and cause a fire. Second, do not use electric cords that have the wires exposed. The wires can come into contact with other objects, animals, or people and cause a fire or electric shock. Third, keep all equipment or appliances away from water. Fourth, never touch, play with, or stick anything into the holes of an electric outlet or socket. And, finally, do not play near power lines in the street or fly a kite close to them.

9 **Read again and complete the chart with four safety rules.**

Electrical Safety			
			
			Never touch, play with, or stick anything into the holes of an electric outlet.

Let's Do It!

1 Delia bought some chickens that she wants to raise. She needs to build a shelter with a box to keep them warm. In pairs, help Delia choose the parts that she will need to build an electric circuit for the box. Circle the parts.

a one heater
b two light bulbs
c wire
d two batteries
e one fan
f one switch

2 What type of electric circuit will be the most efficient for the box? Discuss with your partner.

A ... circuit will be more efficient because ...

3 Help Delia draw a diagram for the most efficient electric circuit. Use the parts from activity 1.

4 If Delia decides to use an electric outlet, instead of batteries, to power the circuit of the box, what safety rules does she need to learn? Write a note to Delia giving her some safety rules.

Hello Delia,

If you use an electric outlet to power the circuit of the box, you need to learn a few safety rules. First,

Best of luck,

Let's Show It!

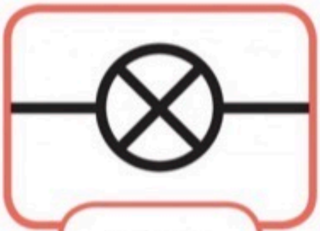
1 Read and complete.

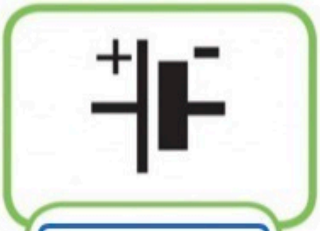
~~protons~~ attract electrons repel open resistance positive closed
electrocution conductors negative insulators static current circuit

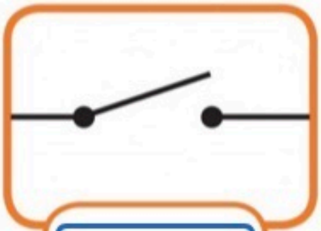
All matter in the universe is formed by atoms. An atom has three particles: [1] protons and neutrons in its nucleus, and [2] ______ traveling in orbits around the nucleus. Protons have a [3] ______ charge (+) and electrons have a [4] ______ charge (-). The positive and negative charges [5] ______ each other. Electrically charged things can attract or [6] ______ each other. If there is no flow, or movement, of electrons in a charged object, then the energy becomes [7] ______ electricity. Electric [8] ______ is the movement, or flow, of electrons through materials. These materials can be [9] ______ or [10] ______. But, even conductors present a property called [11] ______, which makes electric energy turn into heat. Electricity can be transformed into other forms of energy through the use of an electric [12] ______. Electric current flows through a circuit when the switch is closed, as in a [13] ______ circuit. In an [14] ______ circuit, the current can't flow. If not handled safely, electricity can be dangerous and lead to [15] ______.

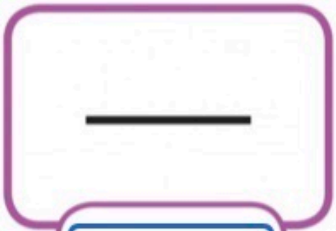
2 Label the symbols with words from the box.

~~resistor~~ conductor power source switch

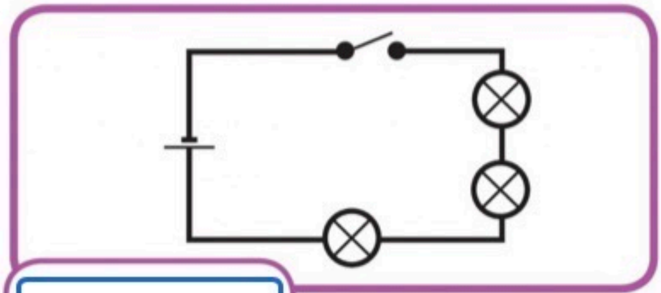

resistor

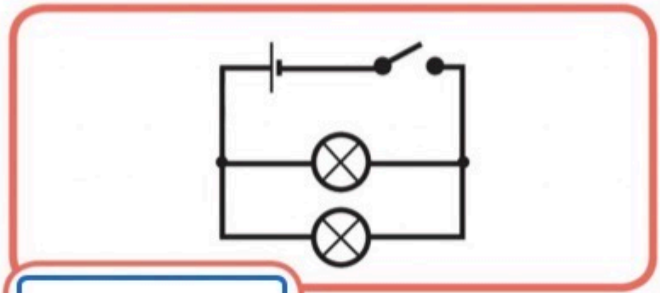

______


______


______

3 Complete the diagrams with the missing parts. Then label them with *series circuit* or *parallel circuit*.


______


______

4 Can the electric current flow through the circuits in activity 3? Explain to your partner.

The electric current in the diagrams can/can't flow because ...

Project

How Does Electric Energy Transform into Heat?

In this project, you will observe and measure the process of energy transfer.

Materials

- One light bulb (65 W)
- One battery (9 V)
- One switch
- Insulated copper wire
- Pliers
- Electric tape
- Aluminum foil
- One cardboard box
- One metal can
- One ceramic cup
- Water
- Thermometer
- Gloves
- Safety glasses
- Timer

Stage 1: Plan your project

1. In groups, draw an electric circuit diagram for your testing box. Use information about electric circuits in activity 5 on page 122.
2. Make two charts to record your data.

Metal Can		
Trials	Minutes	°C
1	0	28
2	15	
3	30	

Ceramic Cup		
Trials	Minutes	°C
1	0	
2	15	
3	30	

Stage 2: Develop your project

1. Secure adult supervision.
2. Assemble your electric circuit and attach it to the box.
3. Pour water into the can. Measure the temperature and record it. Then cover it with foil and place it in the box. Turn the switch on.
4. Turn the switch off before you use the thermometer to record your data every 15 minutes.
5. Repeat steps 3 and 4 with the ceramic cup.
6. Analyze your data. In what container did the temperature of water increase the most? Why? How did that happen?

UNIT 2

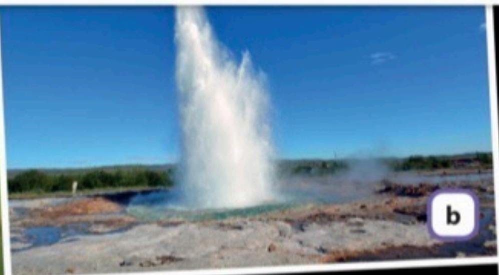
How Does Energy Transform?

Lesson 2: What kind of changes does heat cause?

Learning Goals In this lesson, you will describe heat transfer processes and their importance.

Inquiry Skills You will also identify heat conductors and insulators.

Let's See!



Did you know?
About 90% of a light bulb's energy is transformed into heat.

① Match the pictures to a source of heat.

Sources of Heat	
Man-made	**Natural**
☐ fireplace	a sunrays
☐ iron	☐ wildfire
☐ matches	☐ geothermal power

2 **Are blankets, jackets, and sweaters a source of heat? Discuss with a partner.**

Blankets, jackets, and sweaters are / aren't a source of heat because …

Let's Try!

What Makes Temperature Change?

Your teacher will place the ice in the plastic bowl.

1 In pairs, place one hand in the bowl until it feels cold.

2 Place your cold hand on one side of your neck for about one minute.

3 How did your hand feel after being on your neck for one minute? How did that happen? Discuss with your partner.

Materials

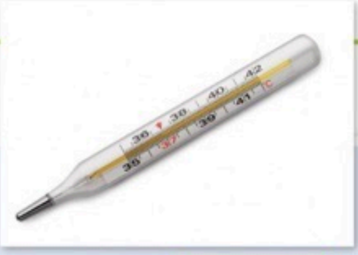
- One plastic bowl

- Ice

My hand felt warm/ cold because …

Let's Learn!

1 **What is heat? Read and answer.**



Heat and Temperature

Thermal energy (the flow of heat) is a form of kinetic energy. This is because molecules (two or more atoms bonded together) in a substance move faster or slower when temperature changes. In other words, an increase in temperature makes molecules move faster and a decrease in temperature makes them move more slowly. Heat is the flow of energy from high temperature to low temperature. For example, when we place a pot of cold water on the stove, the heat from the flame flows to the water (high temperature to low temperature), making the water molecules move faster, which increases the temperature of the water. Temperature can be measured in degrees Celsius (°C) using a thermometer. For example, the normal body temperature of a human being can range from 36.5–37.2°C.

2 **What energy process happens when you begin to feel cold? Complete the explanation. Then read again and infer.**

Feeling cold is the signal my body gives me to tell me that the thermal energy in

3 **Read the thermometer in activity 1. How many °C does it indicate? Is that a normal temperature for a person?**

The thermometer indicates … And, that is/isn't a normal temperature for a person because …

4 **Complete the chart. Then read and check.**

fireworks

ice

cake

vapor

Changes Produced by Heat

State of Matter		Chemical	
		fireworks	

Changes Produced by Heat

The flow of thermal energy changes the temperature of an object, and it can also produce changes of state. For example, heat flow can turn water (liquid) into vapor (gas). For that to happen, water must reach its boiling point at 100°C. On the other hand, when reaching its freezing point at 0°C, water (liquid) turns into ice (solid). Heat can also cause chemical changes in substances. Chemical changes happen when the atoms in the molecules of a substance break apart and bond with atoms in the molecules of another substance. This creates a new substance. These changes are usually permanent. For example, in a water molecule there are two atoms of hydrogen and one of oxygen (H_2O). When H_2O is combined with carbon dioxide (CO_2), they form aqueous carbonic acid (H_2CO_3). This is a new substance, which is found in unopened bottles or cans of soft drinks. An example of a very familiar chemical change produced by heat is baking a cake. When the different ingredients are mixed and then baked in an oven, you cannot separate the original components because a chemical change has happened. Therefore, the change is permanent. Fireworks are another example of a chemical change produced by heat.

5 **What does H_2CO_3 mean? Complete the sentence. Then read again and check.**

When H_2O and CO_2 are combined, their [1] ______ bond together and produce H_2CO_3, which is the chemical formula of the new [2] ______ called carbonic acid.

6 **In pairs, describe three different changes produced by heat and give an example for each.**

Heat can produce a change in ... An example of this is ...

7 **How is heat transferred from one object to another? Discuss in small groups.**

Heat is transferred from one object to another by ... because ...

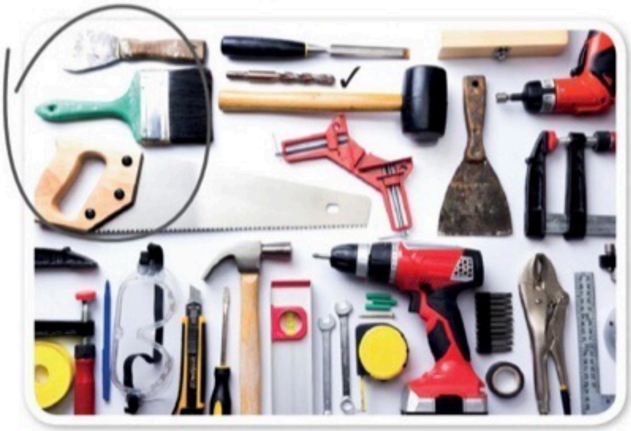
8 **Read and complete.**

water ~~heated~~ process them transfer used thermal heat

Heat Transfer

Thermal energy is transferred in three different ways. The Earth is ^{1} heated by the sun through a heat transfer process called radiation. This means that heat flows through space in waves. The same ^{2} ______ applies when we sit next to a bonfire or a fireplace and we can feel the warmth from the waves originating in the fire. Another form of heat transfer is conduction. In this process, ^{3} ______ energy flows within a substance or object from the area with the highest temperature to the area with the lowest, and from object to object by contact. There are materials that are good thermal conductors, or that allow ^{4} ______ to flow through them easily, such as metal. But, materials that don't conduct heat easily are called thermal insulators, like wood, wool, plastic, or air. Thermal insulators are ^{5} ______ to keep heat from transferring, like in coffee thermoses and blankets. They are also used in the construction industry to keep the interior of buildings cool or warm. The third type of energy transfer is convection. This process allows heat to transfer through the movement of liquids or gases. For example, when water is heated, the hotter areas of it rise while the cooler ones at the top sink. The process creates a circular motion in the ^{6} ______. These three forms of heat ^{7} ______ do not happen in isolation. There is usually more than one occurring. In the example of heating water, we have all of ^{8} ______ present. That is, the flame is in contact with the pot and heat transfer occurs through conduction which, in turn, causes convection. And, there's also thermal radiation taking place that can be felt if one stands close to the flame.

9 **Look at the picture and circle the tools that have thermal insulators and put a check (✓) next to the ones that have materials that can be thermal conductors. Then read again and check.**



10 **What dangerous activities can you see in the pictures? Discuss in small groups. Then read and check.**

Picture ... shows ... which is dangerous because ...

Safety Around Heat Sources

Thermal energy is found everywhere, and it's a vital component of our universe. As a matter of fact, it is so important that we wouldn't be able to survive without it. However, it is also important to recognize heat sources and how to be safe around them. There are three types of injuries caused by heat sources that can result in damage to our organs and tissues, and can even cause death. Radiation burns are usually caused by a lengthy exposure to the sun's ultraviolet rays. Radiation burns can lead to skin cancer. It is important to protect our skin by applying sunblock and limiting our exposure to ultraviolet rays. Thermal burns are most commonly caused by fire and hot liquids or objects. These burns can penetrate several layers of the skin and, if a large portion of the body is burned, it may lead to death. They can leave permanent scars on the skin and disfigure a person. So, it is important not to play with matches or any fire source, to stay away from bonfires and fireplaces, and to never handle hot liquids or any hot object without adult supervision. Chemical burns are caused when, without protecting our eyes and skin, substances are mixed and undergo a chemical change (reaction) or explode, or when a dangerous substance is handled. That is why it is very important to never touch household cleaners without adult supervision, and never mix them or heat them up.

11 **Match the source to the type of burn it can produce. Then read again and check.**

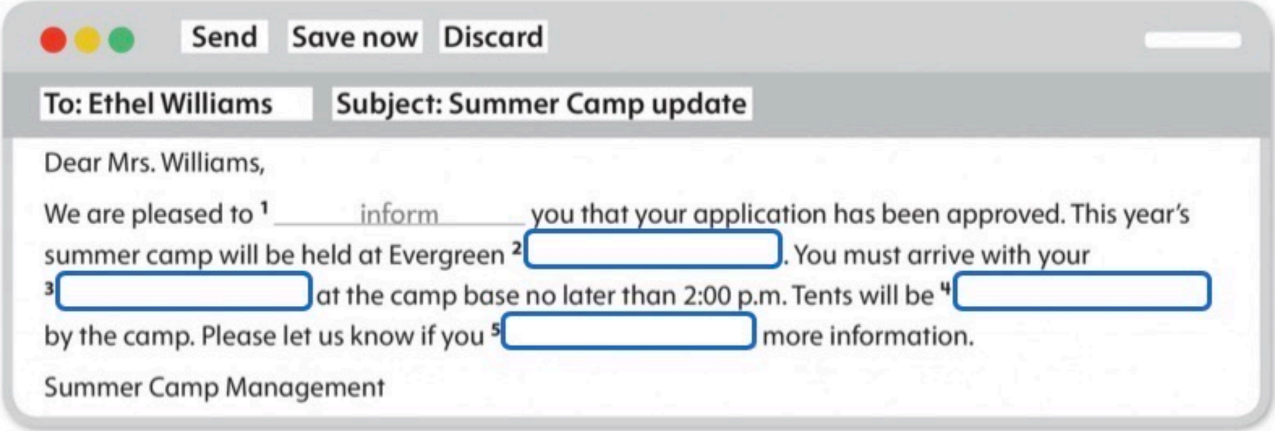
a household bleach ●
b fireplace ●
c matches ●
d lying on the beach ●
e hot soup ●

● **1** radiation burns
● **2** chemical burns
● **3** thermal burns

Let's Do It!

1 **Read and complete the email.**

need provided forest ~~inform~~ son



To: Ethel Williams

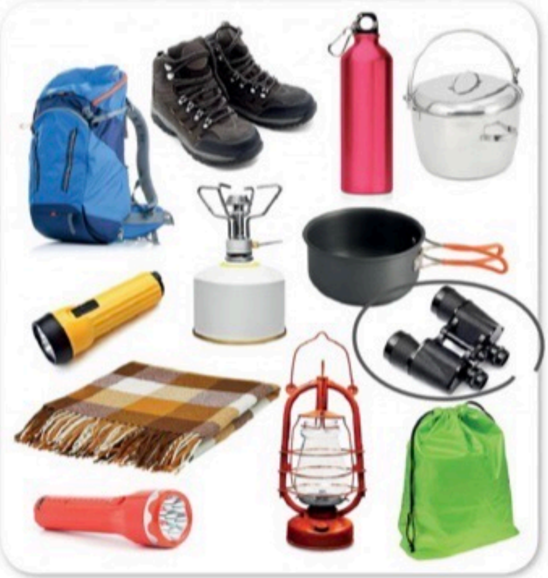
Subject: Summer Camp update

Dear Mrs. Williams,

We are pleased to 1 inform you that your application has been approved. This year's summer camp will be held at Evergreen 2 ______. You must arrive with your 3 ______ at the camp base no later than 2:00 p.m. Tents will be 4 ______ by the camp. Please let us know if you 5 ______ more information.

Summer Camp Management

2 **Listen to Henry and his mom get ready for summer camp. Look at the picture and circle the items they mention.** 23



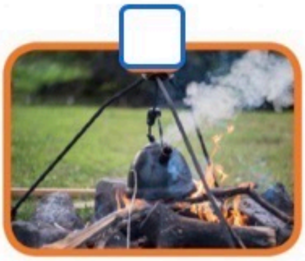
3 **Listen again and complete the chart.** 23

Supplies	Material	Benefit
	wool	insulator
	metal	

4 **What safety rules about heat sources does Henry need to learn? Explain to a partner.**

Henry needs to learn about three types of burns caused by heat sources, such as ... caused by ... He can prevent that by ...

5 **Match the pictures to a type of heat transfer.**

☐


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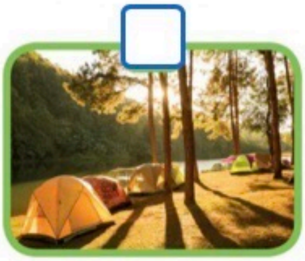
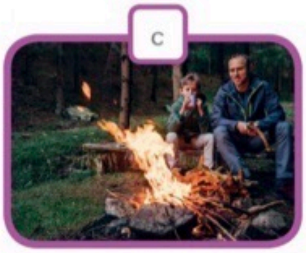
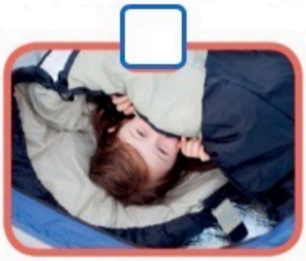


c


☐


a convection **b** conduction **c** radiation

Let's Show It!

1 **Read and complete.**

thermal burns thermometer ~~thermal energy~~ Celsius freezing point
chemical burns molecules radiation burns boiling point temperature chemical changes

1 Thermal energy is a form of kinetic energy in which 2 ________ in a substance move faster or slower when 3 ________ changes. Temperature can be measured in degrees 4 ________ (°C) using a 5 ________. Heat flow can create changes in temperature and state of matter. For example, water can turn from liquid to vapor by reaching its 6 ________ at 100°C. On the other hand, when reaching its 7 ________ at 0°C, water (liquid) turns into ice (solid). Heat can also cause 8 ________ in substances. Thermal energy, or heat, is a vital part of our universe. However, heat sources can cause three types of injuries if we are not careful. 9 ________ are usually caused by a lengthy exposure to the sun's ultraviolet rays. 10 ________ are most commonly caused by fire and hot liquids or objects. And, 11 ________ are caused when our eyes and skin come into contact with certain chemicals.

2 **Complete the chart with a brief description of the different forms of heat transfer.**

Electrical Safety		
Radiation	Conduction	Convection
		This process allows heat to transfer through the movement of liquids or gases.

3 **Classify the following materials.**

plastic wool copper ~~air~~ aluminum steel

Thermal Conductors			Thermal Insulators		
			air		

Project

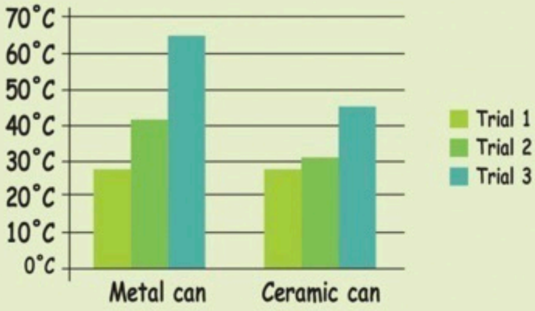
How Does Electric Energy Transform into Heat?

In this project, you will observe and measure the process of energy transfer.

Stage 3: Share your project

1 **Use the information from stages 1 and 2 on page 127 to write a report on your experiment. Follow the report sample on page 7.**

a Make a bar chart to present your results and include it in your report.



Stage 4: Evaluate your project

1 **Ask a classmate to evaluate your report.**

a Is the information clear?

b Are all the sections of a report included?

c Are there any spelling or punctuation mistakes in the report?

d Are the two bar charts included in your report?

2 **What did you learn from conducting this experiment and analyzing the results? What would you like to learn more about?**

UNIT 2

Unit Review

1 Go back and watch the video ▶

2 Now complete the activities on your **Video Worksheet**

What Have You Learned?

1. **Go back to page 103. Write more words for each picture. Which picture has the most words?**
2. **Discuss these questions.**

Is there only one kind of energy?

How does energy transform?

Do You Want to Know More?

Play games, solve puzzles, and find fun energy experiments at this site:
http://www.eia.gov/KIDS/energy.cfm?page=5

Learn more about sounds and hearing by watching videos and playing interactive games at this site:
http://www.dangerousdecibels.org/virtualexhibit/index.html

Learn more about electricity, electric circuits, and safety as you play fun games at this site:
http://www.switchedonkids.org.uk/

Play fun games and watch videos about thermal energy at this site:
http://www.learninggamesforkids.com/heat-energy-games.html

BLOCK 5

Science Fair

Science Fair

In this unit, you will develop a project for a science fair. A science fair is a school event that gives you the opportunity to share your scientific research or discovery with other students and teachers.

Plan Your Project

① Choose a topic.

The Human Body	The Environment	Matter and Materials	Energy and Forces	My Own Topic
Does BMI affect your heart rate?	Do detergents affect plant growth?	Does dirt concentration affect the turbidity of water?	Do loud sounds affect your memory?	

2 **What is a testable question? Read and complete.**

~~meaningful~~ condition change experiment

Scientific discoveries start with [1] meaningful questions that generate careful investigation. Those questions include two important elements called manipulated (independent) and responding (dependent) variables. A manipulated variable is the one condition that is changed in an [2] ☐, such as temperature or velocity. In contrast, a responding variable is the [3] ☐ that is measured in an experiment. In an experiment, there must be certain conditions that don't [4] ☐, which are called controlled variables.

3 **Write testable (T) or not testable (N). Then underline the manipulated variable and circle the responding variable in the testable questions.**

☐ Do detergents make water too polluted for healthy aquatic life?

T Does changing the temperature of water affect the solubility of salt?

☐ How does changing the height of the ramp affect the speed of the rolling ball?

☐ Will a household vacuum pick up a soccer ball?

4 **Research the topic in a library, on the Internet, or by interviewing experts. Take notes as you do your research and do not forget to record where you got the information.**

5 **What is a hypothesis? Underline the correct word.**

Hypothesis

A hypothesis is *a / an* tentative explanation or *a / an* educated guess that states what you think will happen in your experiment. *A / An* scientific hypothesis must be testable. This means that the manipulated and responding variables involved in *a / an* event or phenomenon must be mentioned.

6 **Underline the manipulated variable and circle the responding variable in the following hypotheses.**

a The solubility of salt will be different at different temperatures.

b If you increase the height of the ramp, the speed of the rolling ball will increase.

c When detergents are present in water, aquatic life will not survive.

d The sun will heat salt water and freshwater at different rates.

7 **In small groups, write a hypothesis for your topic.**

8 **What will you do if your hypothesis is incorrect? Discuss with your group.**

If our hypothesis is incorrect, we may have to ...

Develop Your Project

Project 1: Does BMI affect your heart rate?

Materials

- One sheet of paper
- Scale
- Tape measure
- Stethoscope

1. Draw the data chart on the paper.
2. Weigh and measure the height of one volunteer. Then calculate his/her Body Mass Index (BMI) and write it in the chart.
3. Use the stethoscope to count the volunteer's heartbeats per minute at rest and write it in the chart.
4. Instruct the volunteer to jog in place for two minutes. At the end of the two minutes, count the heartbeats per minute and write the data in the chart.
5. Repeat steps 2, 3, and 4 with three more volunteers.
6. Did volunteers with higher BMI have higher heart rates? Why? Discuss in small groups.

Data Chart		
BMI	HR: Before	HR: After
23.5	85	

People with higher BMIs had / didn't have higher heart rates. This means that ... because ...

Project 2: Do detergents affect plant growth?

1. Write a number (1–3) on each pot and place the plants in a well-lit area.
2. Water plant 1 with half a cup of water.
3. Mix one-quarter of a cup detergent with one quarter of a cup water in each measuring cup.
4. Pour one of the water and detergent solutions into plant 2 and the other into 3.
5. Repeat steps 2, 3, and 4 every day for seven days.
6. What happened to the plants? What are the implications of the results of your experiment for biodiversity? Why? Discuss in small groups.

Materials

- Three small potted plants (same species)
- Black marker
- Two measuring cups
- Water
- Detergent

Detergents affect / don't affect plant growth. This can / can't have a ... impact on biodiversity because ...

Project 3: Does dirt concentration affect the turbidity of water?

Materials

- One sheet of paper
- Three transparent plastic cups
- Water
- One cup of dirt
- Stirring rod
- Flashlight
- Two coffee filters
- One kitchen sieve

1. Draw the turbidity scale and data chart on the paper.
2. Pour the water and dirt into a cup. Stir.
3. Hold the lit flashlight against the cup and look. Use the turbidity scale to estimate the level and write the number in the data chart.
4. Place a filter inside the sieve and over a plastic cup. Pour the mixture into it.
5. Repeat step 2 twice.
6. How could high turbidity affect aquatic life?

Turbidity Scale				
0	1	2	3	4
Clear	Low	Medium	High	No visibility

Data Chart	
Trial	Turbidity Level
1	3.5
2	2.5

High turbidity levels can have a ... impact on aquatic life because ...

Project 4: Do loud sounds affect your memory?

1. Write one number (1–9) on each index card.
2. Draw the data chart on the paper.
3. Play the music at low volume for a volunteer.
4. Show the volunteer seven cards, one at a time, in random order. Stop the recording and have the volunteer repeat the numbers.
   Write results in the chart.
5. Play the recording at high volume. Repeat step 4.
6. Repeat steps 4 and 5 with four more volunteers.
7. What are the implications of your results for studying habits? Discuss in small groups.

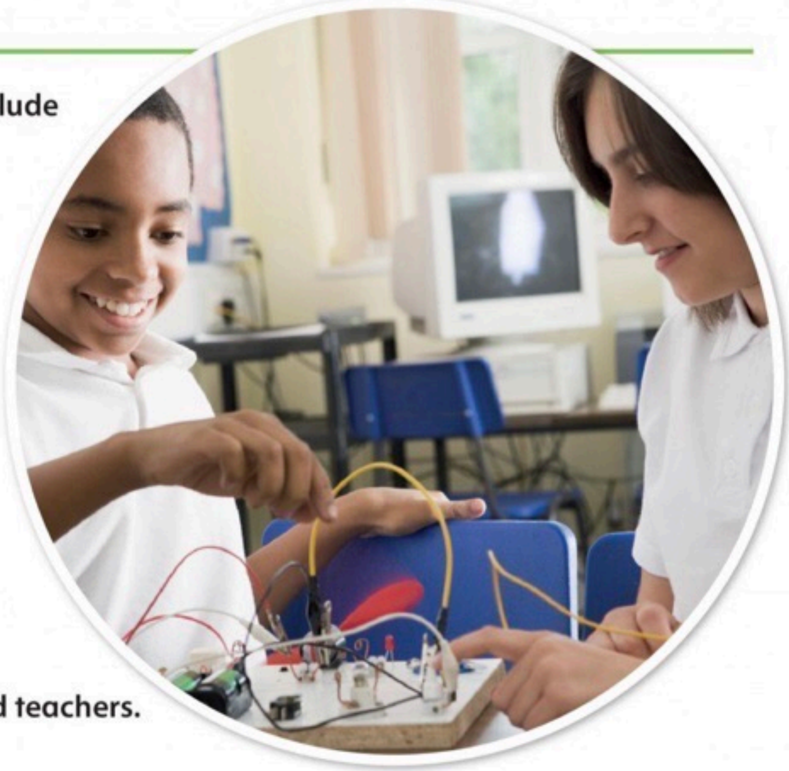
High/low volume of sound affects/doesn't affect studying habits because ...

Materials

- Nine index cards
- One black marker
- One sheet of paper
- Music player
- One recording of classical music.

Data Chart		
Volunteers	Low Volume	High Volume
Jimena	6	
Verónica	7	
Jorge	4	
Average	5.67	

Share Your Project



1. **Make a science fair display board and include the following sections:**
    - **a** Title, testable question, and hypothesis
    - **b** Materials
    - **c** Method
    - **d** Research
    - **e** Results and conclusion
2. **Include pictures, graphs, and charts to support your data.**
3. **Write a report on your experiment.**
4. **Present your project to other students and teachers.**

Evaluate Your Project

1. **Ask your classmates to evaluate your science fair display board.**
    - **a** Are all the sections included in the science fair display board?
    - **b** Does the display board include at least three visual elements to support data?
    - **c** Is the display well organized and neat?
    - **d** Are there any spelling or punctuation mistakes?
2. **Ask your classmates to evaluate your presentation.**
    - **a** Is the presentation clear?
    - **b** Do you make eye contact with your audience?
    - **c** Do you give time at the end of your presentation for your audience to ask questions?
3. **What did you learn from the science fair experience? What would you do differently?**

Glossary

BLOCK 1 The Human Body

Unit 1: What Happens If I Don't Keep a Healthy Weight?

Lesson 1: How are food and energy related?

Basal Metabolic Rate (BMR) the amount of energy expressed in calories that a person needs for essential body functions

calorie the unit of energy contained in foods and drinks; in science, a calorie is the amount of heat it takes to raise the temperature of 1 gram of water 1˚C

$\text{Energy}_{\text{in}}$ the energy we receive from proteins, carbohydrates, and fats

$\text{Energy}_{\text{out}}$ the total energy used for essential body functions (BMR) and physical activities

energy balance a state in which the amount of $\text{Energy}_{\text{in}}$ equals the amount of $\text{Energy}_{\text{out}}$

food label a panel of information found on food containers stating the nutritional values of the food or drink

serving size the amount or portion of a food or drink that is served

Lesson 2: How does energy imbalance affect my health?

anorexia nervosa an eating disorder characterized by significant weight loss due to a refusal to eat, eating very little, or over-exercising

Body Mass Index (BMI) a calculation that uses the weight and height of a person to assess body fat

bulimia an eating disorder characterized by eating a lot and then vomiting or taking laxatives to purge the body

diabetes mellitus a metabolic disease in which the levels of glucose in the blood are higher than normal

eating disorders the unhealthy attitudes toward food that cause a person to change eating habits and behaviors

glucose a type of sugar in the blood that the human body uses for energy

insulin a hormone produced and secreted by the pancreas, and in charge of controlling the levels of glucose in the body

malnutrition a condition associated with a deficit of vitamins, minerals, and nutrients in a person's diet

normal weight the body weight of a person with a Body Mass Index (BMI) within the range of 18.5–24.9

obesity the body weight of a person with an associated Body Mass Index (BMI) of 30.0 or higher

overweight the body weight of a person with an associated Body Mass Index (BMI) within the range of 25.9–29.9

pancreas the gland located behind the stomach that secretes insulin

underweight the body weight of a person with an associated Body Mass Index (BMI) below 18.5

Unit 2: How Do We Change and Develop in Our Lifetime?

Lesson 1: What are the stages of life?

adolescence the period of your life when you change from being a child to being a young adult

adulthood the period of your life when you are an adult

aging process the things which happen to our bodies as we grow older

bone density the relationship between the weight of bones and their size

cataracts a disease in which the eye becomes white and you gradually lose the ability to see

cells the smallest living part of an animal or a plant

cerebellum the part of the brain which controls balance and coordination

childhood the part of your life when you are a child

coordination the ability to make different parts of your body move together in a controlled way

ear canal a tube leading from the outer to the inner ear

eardrum the middle part of the ear which moves in response to sound waves, allowing us to hear

elderly a person who is old

emotional related to how you feel

empathy the ability to understand how another person feels

fetus a developing baby human or animal, before it is born

fine motor skills relating to muscles that produce small movement and the nerves and parts of the brain that control these muscles

frontal lobe the part of the brain that is immediately behind the forehead that controls planning, weighing risks, and decision-making

glaucoma a disease in which you gradually lose the ability to see

gross motor skills relating to muscles that produce large movement and the nerves and parts of the brain that control these muscles

growth spurt when a person grows a lot in a short period of time

(high) blood pressure a measure of the pressure at which the blood flows through the body

hormones a chemical produced by the body

impulse control when we think before we act

independent able to take care of yourself without help from others

infancy the period from when a person is born to age two

interact communicate with another person

melanin the substance that gives our hair its color

mood swings a sudden, unexpected change in the way that someone feels and behaves

neuron a cell which sends and receives messages to and from the brain

neurotransmitter chemicals which send messages to the brain

occipital lobe the part of the brain which controls our vision

old age the period of your life when you are old

parietal lobe the part of the brain which helps us distinguish size, shape, and color

physical relating to the body and not the mind

puberty the stage of development when a child changes physically into an adult

self-esteem feeling good about yourself

social relating to being with other people

stamina the ability to do physical exercise for a long time without getting tired

strength the ability to lift or move heavy things

temporal lobe the part of the brain which controls memory

womb the place in a woman's body where a baby grows

Lesson 2: How can we care for people throughout their lifetime?

acceptance being made to feel welcome and part of a group

behavior the way someone behaves

belonging feeling happy and comfortable in a place or with a group of people

community a group of people who live close to each other

caregiver someone who looks after another person or people

esteem respect and admiration

identity the qualities that make someone unique and different from other people

motivation a feeling of wanting to do something

needs the things that you need in order to be comfortable or happy

physiological relating to the human body and how it works

potential the possibility to achieve something in the future

psychological relating to the mind, rather than the body

recognition being rewarded or praised for doing something good

respect a feeling of admiration for another person

safety being safe or secure

security being protected from harm

self-actualization being the best person you can be

shelter a place where you are protected from bad weather

society the people who live in the same place at the same time

survival staying alive

umbilical cord the tube that connects a fetus to its mother and through which it receives food and oxygen

BLOCK 2 The Environment

Unit 1: What Will Happen If We Don't Protect Our Ecosystems?

Lesson 1: Why is biodiversity important?

abiotic factors the nonliving elements of an ecosystem

acellular a structure without cells

animalae the eukaryotic, multicellular organisms: all animals

archaea the prokaryotic, unicellular, bacteria-like micro-organisms that live under extreme conditions

bacterium plural **bacteria** the prokaryotic, unicellular micro-organisms

biodiversity the great variety of species or groups of plants, animals, and micro-organisms that live in ecosystems

biotic factors the living things within an ecosystem

development the characteristic of living things that involves developing physical adult characteristics, or maturity

eukaryotae the group of organisms with cells that include a membrane and a nucleus

fungus plural **fungi** the eukaryotic, multi-cellular organisms, such as mushrooms

growth the characteristic of living things that involves increasing in size

irritability the characteristic of living things that involves responding to changes in their environment

metabolism the characteristic of living things that involves using chemical energy, such as from food, to carry out life processes

movement the characteristic of living things that involves the ability to present internal and/or external motion

multicellular an organism with more than one cell

plantae the eukaryotic, multicellular organisms: all plants

prokaryotae the smallest and most ancient group of organisms with cells that don't have a nucleus

protista the eukaryotic, unicellular micro-organisms

reproduction the characteristic of living things that involves creating other organisms of the same species

unicellular the organisms with only one cell

virus the acellular microbes that can only become active inside a living cell, or host

Lesson 2: What happens when a region loses its native plants and animals?

dam a barrier built across a river to prevent the flow of water or to retain water

endangered species a species at a very high risk of becoming extinct

endemic species the plants and animals that are native to a particular region of the world

flood the excessive amount of water on dry land that the soil is unable to absorb

habitat degradation a decline in the quality of a habitat

habitat destruction the process of damaging the natural habitat of species that results in serious biodiversity loss

habitat fragmentation the process of cutting up into fragments the species' terrestrial or aquatic habitats

habitat loss the process in which a habitat becomes unable to meet the needs of its resident species

invasive species an organism that is not native to an ecosystem

landslides the process in which a large portion of soil slides down a slope

logging the practice of cutting trees to sell them as timber or pulp

scarcity a condition in which food or other resources are insufficiently available

soil erosion the loss of topsoil due to natural, animal, or human activity

trawling a fishing method in which a fishnet is dragged through deep waters

urban sprawl the uncontrolled spread of houses or buildings around a city

wildfires the naturally occurring fires that spread rapidly

Unit 2: Why Are Ecosystems So Important?

Lesson 1: What do ecosystems do for all of us?

biome large geographical area with plants and animals that have adapted to the specific climate of the region

climate the prevailing weather conditions of a region, including rainfall, temperature, and wind

cultural services the non-material benefits that ecosystems provide to people

desert a type of biome subdivided into hot and dry, semi-arid, coastal, and cold

forest a type of biome subdivided into tropical, temperate, and boreal

freshwater a type of biome subdivided into ponds and lakes, streams and rivers, and wetlands

grassland a type of biome subdivided into savannah, temperate, and steppes

marine a type of biome subdivided into oceans, coral reefs, and estuaries

provisioning services the raw materials obtained from ecosystems, such as wood for paper or furniture

regulating services the benefits received from activities within ecosystems that regulate processes in nature

supporting services the benefits provided by ecosystems that are fundamental for the other ecosystem services

tundra a type of biome subdivided into Arctic and alpine

Lesson 2: What can we do to care for ecosystems?

compost a mixture of decomposing organic matter that is usually used to nourish soil

crops the plants, vegetables, fruit, or grains cultivated in agriculture

grazing the process in which animals feed on herbs or grasses

gyres the circular ocean currents

horizons the layers of soil

livestock the animals raised on a farm

manure the animal waste or feces that is usually used to fertilize soil

mulch a protective layer of organic matter, like leaves or straw, placed mainly to prevent loss of soil moisture

smart growth an urban strategy that is employed to create communities that protect the natural environment

soil the top layer of the surface of the Earth

sustainable agriculture a type of agriculture that avoids depleting the Earth's resources or polluting the environment

sustainable communities the places where people are aware of the need to protect ecosystems

topsoil the upper, most productive layer of soil that is rich in nutrients

3Rs (reduce, reuse, recycle) the programs aimed at reducing the amount of waste generated by people

BLOCK 3 Matter and Materials

Unit 1: Why Is Water Important for Our Planet?

Lesson 1: How does water function as a solvent?

breath the air going in and out of the lungs during respiration

concentration the amount of solute dissolved or contained in a given solution

dehydration the process in which more fluids leave the body than the amount that it receives

diarrhea excessive watery feces eliminated due to an illness

freshwater the water necessary for the survival of most species

homogeneous a condition that makes something uniform

perspiration the process of sweating or release of moisture through skin pores

solubility the amount of a substance that is able to dissolve in a specific amount of a solvent, and that is affected by temperature

solute the subtance that dissolves in a solvent to form a solution

solution a homogeneous mixture formed by two or more substances

solvent the part of the solution that does the dissolving

water loss the water the body loses from sweating, breathing, urination, or illnesses like diarrhea

Lesson 2: How can we prevent water pollution?

activated sludge a deposit of mud-like waste at the bottom of water that contains bacteria

aeration tanks the containers where wastewater is injected with air to increase its oxygen

bar screens the devices that have parallel bars to remove debris

chlorine the substance added to disinfect wastewater

clarification tanks the large containers that hold wastewater to allow suspended solids to settle to the bottom

effluent the disinfected water from a treatment plant which is discharged into rivers, lakes, or oceans

grit tanks the containers that allow wastewater to flow at a very slow speed so that small objects settle to the bottom

influent the wastewater going into a residual water treatment plant

petroleum distillates the type of products that are produced from crude oil, some of which are heavy pollutants

phosphates the inorganic substances in many products that are associated with pollution

residual water treatment plant the facility where wastewater from houses and industry becomes disinfected

scum a layer of dirt that forms and floats on the surface of wastewater

sedimentation tanks the containers of wastewater where suspended solids settle to the bottom

septic tank a small, underground wastewater treatment container

sludge the semisolid dirt that forms in the bottom of wastewater

stabilization pond a large body of water made by people to treat wastewater in a natural way

total suspended solids (TSS) the measurement used to determine water quality, which is provided by the dry-weight of particles trapped by a filter

turbidity the state of water in which suspended solids prevent the passage of light

wastewater the water after it has been used in houses, industry, or agriculture

Unit 2: What Mixtures Are There in Our Environment?

Lesson 1: How do mixtures separate?

colloid a homogeneous mixture formed by two or more substances that contains tiny droplets or solid particles of a solute

component a substance that is part of a mixture

distillation a physical method to separate mixtures through boiling and condensation

evaporation a physical method to separate mixtures by turning a liquid into gas

filtration a physical method to separate mixtures through the use of a porous object like paper or sand

heterogeneous a condition that shows the different elements of something

magnetic method a physical method to separate metal or magnetic components in a mixture

mixture the combination of two or more substances

physical changes the changes in state of matter, color, shape, size, or texture that substances or materials go through

pure substances the substances that cannot be separated by physical means like sieving or filtration, and that consist of only one component

sieving a physical method to separate mixtures through the use of a wire mesh

suspension a heterogeneous mixture

Lesson 2: How can we care for our atmosphere?

atmosphere the area with gases that surrounds the Earth

biomass power the energy generated from organic waste or matter

carbon monoxide (CO) an odorless, colorless toxic gas produced when combustion of substances like oil, gas, or wood happens with insufficient air

emissions the substances discharged into the air that are usually associated with pollution

fossil fuels the natural resources like oil and natural gas that are formed from the remains of ancient plants and animals

geothermal power the energy generated by the steam or heat coming from deep within the Earth

nitrogen dioxide (NO_2) a highly poisonous brown gas commonly found in smog

ozone (O_3) a colorless gas that is very toxic when found in the troposphere

particulate matter (PM) the small particles or droplets suspended in the air; usually associated with pollution

solar power the energy received from the sun that can be converted into electricity

stratosphere the layer of the atmosphere located above the troposphere

sulfur dioxide (SO_2) a toxic, colorless gas usually associated with pollution

troposphere the layer of the atmosphere closest to the Earth's surface

volatile organic compounds (VOCs) the organic chemicals that generate vapors at room temperature

wind power the energy generated by the wind

BLOCK 4 Energy and Forces

Unit 1: Is There Only One Kind of Energy?

Lesson 1: Why do astronauts seem to float?

energy the ability to do work or change the chemical or physical properties of matter

escape velocity the speed necessary for an object to break away from another object's gravitational force

force of attraction the force that pulls one object toward another

freefalling a downward movement of an object caused by the gravitational force of the Earth

gravitational potential energy (PE_{grav}) the energy in matter that depends on the mass of the object and its position (height)

gravity the natural force of attraction that pulls objects toward one another

Joule (J) the unit of measurement of work or energy

Law of Universal Gravitation a law that describes an existing attraction, or gravitational force, among objects

mass the amount of matter in an object that can be measured in kilograms (kg)

matter a physical object or anything that exists and that occupies space and has mass

Newton (N) the unit of measurement of weight

non-renewable sources of energy the sources of energy that cannot be easily replenished

potential energy the energy in matter that results from its formation or position

ocean currents the movement or circulation of water in the Earth's oceans that is determined by the force of attraction between the moon, the Earth, and the sun

renewable sources of energy the sources of energy found in unlimited quantities in nature, such as solar, wind, biomass, and geothermal power

variables the conditions, or factors, that can be manipulated or changed

weight a force caused by gravity which pulls an object toward the center of another and is measured in Newtons (N)

Lesson 2: What is sound and how does it work?

amplitude the measurement of the amount of energy contained in a sound wave, or its volume

anvil one of the three small bones located in the middle ear that transmits a series of vibrations

auditory nerve an area that starts in the cochlea and is in charge of sending sound information to the brain

cochlea the spiral-shaped structure located in the inner ear that contains fluids and hair cells, and is in charge of sending electric impulses to the auditory nerve

decibels (dB) the sound intensity unit of measurement

ear canal the part of the outer ear that is covered by skin and connects the pinna to the inner ear

eardrum a thin membrane that separates the outer ear from the middle ear and that vibrates as a result of incoming sound waves

earplugs the materials placed in the ear canal to protect the ears from noise, water or air

echo the reflected sound waves usually heard in areas with large, open spaces

frequency the number of sound waves that pass a point in one second and measured in Hertz (Hz)

hammer the first of three small bones located in the inner ear that responds to the vibrations caused by the eardrum

Hertz (Hz) the unit of measurement of sound wave frequency

infrasound any sound wave with a frequency lower than 20 Hertz (Hz)

intensity the amplitude of a sound wave, or its volume

medium the element through which sound waves propagate, such as air or water

noise pollution the environmental condition that presents escalating or disturbing sounds, and that may cause health problems

pinna the external part of the ear that directs sound waves into the eardrum

pitch the interpretation of a sound frequency by the human ear

propagate the process of transmission of sound waves through a medium

reflection the process in which a sound wave bounces back from a surface

sound a disturbance, or wave, produced by the vibration of particles in a substance

stirrup the last of the three small bones located in the inner ear that passes on vibrations to the cochlea

ultrasound any sound wave with a frequency higher than 20,000 Hertz (Hz) which cannot be perceived by the human ear

vibration the oscillatory motion of a particle

wave a disturbance, or vibration, produced in a medium

wavelength the distance between the crests of two waves

Unit 2: How Does Energy Transform?

Lesson 1: How does an electric circuit produce light?

atom the smallest fundamental unit of matter that contains in its nucleus neutrons and protons, and also has electrons orbiting around the nucleus

attract the force that makes objects move toward each other when they have different electric charges

closed circuit a system that allows electric current to flow when the switch is closed, or on

conductors the materials that allow the flow of electric current easily, like metals

electric circuit a system with a path through which electric current flows

electric current the movement, or flow, of electrons through materials

electric energy the energy generated by the flow of electric charges through conductors

electrocution a fatal, or deadly, accident caused by an electric shock

electrons the subatomic particles that have a negative charge and that move around, or orbit, the nucleus of an atom

insulators the materials that do not easily allow the flow of electric current

negative charge the electric charge that electrons carry (-)

open circuit a system that does not allow electric current to flow when the switch is open, or off

parallel circuit an electric circuit that allows electric current to flow through different branches without disruption

positive charge the charge that protons carry (+)

power source the component that supplies energy to a circuit, such as a battery

protons the subatomic particles that carry a positive charge and that are located in the nucleus of an atom

repel the force that pushes objects away from each other when they have the same type of charge (++) (--)

resistance a property that indicates how much materials oppose the flow of electric current

resistor a component of an electric circuit that transforms electric energy into another form of energy, such as sound, light, or heat

series circuit a circuit where electric current flows from one resistor to the next

static electricity a standing, or stationary, electric charge that has no flow or movement of electrons

switch the component of an electric circuit that is used to allow or interrupt the flow of electric current

Lesson 2: What kind of changes does heat cause?

boiling point the temperature a substance or object must reach to begin the process of boiling

chemical burns the injuries caused to skin or tissue by toxic substances or chemicals

chemical changes the changes in composition of a substance that are usually irreversible

conduction the transfer of thermal energy that occurs through the direct contact of an object with another

convection the transfer of thermal energy that occurs by the circulation, or diffusion, of particles in a substance

degrees Celsius (°C) a metric scale used to measure temperature

freezing point the temperature at which a liquid freezes and turns into a solid

heat the flow of thermal energy from high to low temperature

molecules the elements of a substance that are made up by two or more atoms bonded together

radiation the transfer of thermal energy through electromagnetic waves, such as light rays and radio waves

radiation burns the injuries to skin or tissue that are usually caused by prolonged exposure to the sun's ultraviolet rays

temperature the average kinetic energy of molecules in a sample of substance or matter

thermal burns the injuries to skin or tissue that are commonly caused by fire, steam, hot liquids, or objects

thermal conductors the materials that easily allow thermal energy to flow, such as metals

thermal energy a form of kinetic energy in which molecules in a substance or matter move faster or slower when temperature changes

thermal insulators the materials that do not easily allow the flow of thermal energy, such as wood, plastic, or air

thermometer an instrument used to measure temperature